

School of Computing
& Information Systems

**Investigating the Role and Impact of an Information System in
Accrediting and Delivering Breast-screening Services in
Tasmania: a Nexus between Accreditation and Practice**

A dissertation submitted to the Faculty of Science, Engineering
and Technology, University of Tasmania in fulfilment of the
requirements for the Degree of Doctor of Philosophy

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Statement of Originality and Access Authority

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July 2009

Abstract

This dissertation presents a multi-method research approach for the systematic study of wicked problem domains (Rittel, 1984 [1972]), developed through an investigation of an information system (IS) within a health service organisation, BreastScreen Tasmania (BST). BST is an accredited organisation within a national screening and assessment Program, BreastScreen Australia. The Program is a population health initiative that also provides multi-disciplinary diagnostic clinical services to individual clients/patients, measured against 176 National Accreditation Standards.

The demographic change of ageing population is a crisis that threatens the sustainability of future health services and highlights a role for IS/ICT to deliver work efficiencies. Conflicting perspectives and competing models for assuring the quality and safety of health services assume a role for IS/ICT to provide data processing capabilities to support health service practices and to evaluate health service outcomes. An 'e-health' vision assumes that well-integrated information and standardised work practices will result in efficiency, effectiveness, safety and quality. But IS/ICT solutions often fail to accommodate the complexities of information use in health settings. This situation of competing perspectives, opposing forces and health IS/ICT failures indicates that health service delivery into the future is a wicked problem that cannot be easily defined and will not be solved by better IS design.

The methodological contribution of this research is a structured process of inquiry that emphasises a human-centred perspective: *patient-centred care*, *human centred computing* and *human centred research*. The dissertation shows how a multi-method approach is systematically conducted, how appreciation of a problem situation for an organisation emerges and is studied over three-phases. Soft Systems Methodology was adopted as the conceptual framework for the research process. Grounded Theory Methodology provided a range of flexible strategies and lenses for qualitative data collection and analysis. A construct, 'People, place and things' (PPT), was developed and used as a heuristic device to sensitise the researcher to different units of analysis, techniques and lenses for structuring and modelling data, particularly drawing on Distributed Cognition, Communities of Practice and Activity Theory.

Substantively, the research contributes a detailed single case of a health service delivery organisation with wicked problem properties. The investigation focused on the role and impact of a client record (electronic and paper) on two BST activities and their inter-relationships. Firstly, accrediting the delivery of its breast screening and assessment services and secondly supporting decision-making of both individual clinicians and clients/patients. More broadly, it also analysed how the IS impacted on the roles and interactions amongst the professionals working within BST. BST's problem situation was identified as a *nexus between accreditation and practice* in which two forms of accreditation are in tension. These tensions are embedded in the information system supporting BST activities. BST uses a client information system to measure its performance at organisation level, which can conflict with social forms of accreditation such as professional memberships. This conflict is mirrored by the difference between population-level, evidence-oriented data and the meaning of data in the context of a specific client receiving a health service.

Theoretically, the research contributes two conceptual models. Model one highlights that the *nexus* is embedded in the organisation's information system and work practice design such that two forms of accreditation are in tension and must be managed. Artefacts used to measure performance construct organisation-level accreditation; individuals are accredited socially via membership. Model two highlights that the client record is fully integrated to provide data that is oriented to support three different purposes: evidence of organisation performance, supporting professional judgment and client decision-making. Boundary maintenance activities by a staff member in the role of institutional broker are required to manage the differences in meaning for each information orientation.

This research has implications for the role of IS/ICT in health service delivery and accreditation, including assumptions on the benefits of information integration and work practice standardisation. IS design can readily embed principles and work processes that align with measuring standardised work by population-level data for health service quality assurance. However, the wicked problem characteristics affecting health services means that IS that prioritises population-level data-oriented accrediting models can fail to provide information to support social information interactions, including how work is measured for quality within professional memberships. In addition, providing an information system to monitor performance is important, but IS/ICT is also needed to effectively support health service practitioners and clients in making decisions and to provide feedback on individual performance.

The outcomes of using this method demonstrate the value of a three phase, process inquiry approach utilising multiple methods. Socio-technical perspectives are useful for understanding wicked problem domains and the PPT-construct keeps the analysis open to a range of insights for understanding the information support provided in the context of health care delivery. Identifying social insights and social methods of measuring quality of performance of relevance to IS design is time consuming but critical to facilitate human-centred uses of information being supported by the design of technical artefacts for health service delivery contexts. IS design to support standardised work processes and that embeds non-social, quantitative forms of measuring that work is relatively straightforward. Understanding, modelling and developing IS that reflects social insights is much more complex but critical if the e-health IS are to have a positive impact on the current vision for patient-centred, safe and quality assured, effective and efficient health services into the future.

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Faith in God is not a pre-requisite for caring about people or seeking to benefit others. Indeed, religious affiliation can be strongly connected to an inability to understand other viewpoints or tolerate difference. However, the example of Jesus has guided my thinking and actions since I was 15. His teaching and example is the ultimate source of my desire to be ‘human-centred’ rather than self-centred.

Peer Reviewed Publications

- Kelder, J.-A. (2003, 13 - 17 July). *Using Distributed Cognition Theory to Examine Weather Forecasting*. Paper presented at the ICCS/ASCS-2003 Joint International Conference on Cognitive Science, Sydney.
- Kelder, J.-A., & Turner, P. (2004, April 14-16). *In the Eye of the Storm: the role of Distributed Cognition theory for informing the design of meteorological information systems*. Paper presented at the ISOneWorld Conference, Las Vegas.
- Kelder, J.-A., & Turner, P. (2004, Nov 22-24). *Capturing User Experience: Using Distributed Cognition Theory to Inform the Sustainable Design of Meteorological Information Systems in Australia*. Paper presented at the OZCHI 2004, Woollongong, Australia.
- Kelder, J.-A. (2005, January). *Using someone else's data: problems, pragmatics and provisions [56 paragraphs]*. Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, [On-line Journal], 6(1), Art. 39. Available: <http://www.qualitative-research.net/fqs-texte/1-05/05-1-39-e.htm> [2005, January].
- Kelder, J.-A., & Turner, P. (2005, November 24-25). *Lost in Translation? Critical Reflection on Qualitative Approaches for Informing Information Systems Design*. Paper presented at the QualIT, Brisbane.
- Kelder, J.-A., & Turner, P. (2005). People, Places and Things: Leveraging Insights from Distributed Cognition Theory to Enhance the User-Centered Design of Meteorological Information Systems. *Journal of Information Technology Theory and Application (JITTA)*, 7(1), 77-92.
- Kelder, J.-A., & Turner, P. (2005, 22nd November). *To Build or not to Build? That is the Question: conditions of possibility in Translation for Design*. Paper presented at the OZCHI 2005 Workshop on Appropriate Methods for Design in Complex and Sensitive Settings, Canberra.
- Kelder, J.-A., & Turner, P. (2007, July 3-6, 2007). *Qualitative Research and Information Systems Design - Critical reflections from an eHealth Case study*. Paper presented at the 11th Pacific Asia Conference on Information Systems, Auckland, NZ.
- Kelder, J.-A. (2007, August 20-24). *Health Care Service Organisations and Professionals: An Information Systems Model for Transforming the Nexus between Accreditation and Practice*. Paper presented at the International Medical Informatics Conference (Medinfo), Brisbane.
- Kelder, J.-A., & Turner, P. (2008, January 7-10). *An Information Ecology Structured by a Nexus between Accreditation and Practice: Boundary Objects, Brokers and Translation across the Boundaries of Standards Compliance and Practice-oriented Work*. Paper presented at the Hawaii International Conference on System Sciences (HICSS-41), Hawaii.
- Kelder, J.-A., Lueg, C., & Turner, P. (2008). *Supporting Community Knowledge Brokers: Information System Challenges in Breast Screening Service Delivery*, Health Informatics Conference 2008. Melbourne.

Glossary

BSA	BreastScreen Australia
BST	BreastScreen Tasmania
CCM	Culturally Competent Medicine
CME	Continuing Medical Education
CPD	Continuing Professional Development
EBM	Evidence-Based Medicine
GTM	Grounded Theory Methodology
NQMC	National Quality Management Committee
PPT	People, Place and Things
SAC	State Accreditation Committee
SSM	Soft Systems Methodology
‘tame problems’	“an exhaustive formulation can be stated containing all the information the problem-solver needs for understanding and solving the problem” (Rittel & Weber, 1973: 161)
‘wicked problems’	Real world problems: ill-structured; subject to contested formulation; dependent on individual perspectives, susceptible to changing form during analysis and to evolving in nature during solution processes (Rosenhead & Mingers, 2001)

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CHAPTER ONE – INTRODUCTION

CHAPTER 1 INTRODUCTION

Health service delivery in Australia is characterised by tensions and conflicts emerging from competing perspectives and opposing forces. Such characteristics are termed ‘wicked’ (Rittel, 1984 [1972]) or ‘ill-structured’ problem situations. This dissertation presents a three-phase multi-method approach to study, understand and analyse wicked problem domains (Rittel, 1984 [1972]) developed through an investigation of an information system (IS) within a health service organisation, BreastScreen Tasmania (BST).

The method is a structured process of inquiry to BST that emphasises a human-centred perspective: *patient-centred care*, *human centred computing* and *human centred research*. The investigation focused on the role and impact of a client record (electronic and paper) on two organisational activities and their inter-relationships. Firstly, accrediting the delivery of breast screening and assessment services, and secondly supporting the decisions both of individual clinicians and clients/patients. More broadly, this research also provides an analysis of how the IS impacts on the roles and interactions amongst the professionals working within BST.

The outcome is a substantive grounded theory and conceptual model that explains the *nexus between accreditation and practice* in healthcare service organisations; a conceptual model of the boundary maintenance implications of evidence-based healthcare evaluation and a theory of method that uses a People, Place and Things framework to guide the application of three socio-technical theories used in socially-situated research.

There is little doubt that health care delivery and providing information support for health care services is complex and problematic:

The ageing population is a global phenomenon. Understanding its consequences is of key importance for our common future and will affect economic and social structures.¹ The ageing of the population is one of the major transformations being experienced by Australia’s population, and is a current focus for both economic and social policy.²

Healthcare is a communication- and information-intensive sector with a history of mixed success with introduction and use of information systems.³ There has been a significant international debate about whether or not the much touted savings and benefits from implementing eHealth systems can be gained or indeed, even measured.⁴

¹ (Brändström, 2007)

² 4102.0 - Australian Social Trends, 2004
<http://www.abs.gov.au/ausstats/abs@.nsf/0/95560b5d7449b135ca256e9e001fd879?OpenDocument>
accessed 16/02/2009

³ (Sørby & Nytrø, 2007)

⁴ Australian Health Information Council *eHealth Future Directions Briefing Paper* for AHMAC meeting 4 October 2007
<http://www.health.gov.au/internet/main/publishing.nsf/Content/ehealth-futuredirections#4> accessed 16/02/2009

Successes of technology implementations in health care are advertised extravagantly, but the failures are tugged under the carpet.⁵ ... many – even most – health care information systems are failures.⁶ Healthcare IT systems that are developed without a deep understanding of the healthcare work domain can only reflect a guess of how such systems should be configured.⁷ ... the implementation of e-health in hospitals and healthcare organizations is a challenge that has to be overcome from many angles if e-health is to succeed.⁸

Every wicked problem can be considered to be a symptom of another problem.⁹ One cannot understand the problem without knowing about its context; one cannot meaningfully search for information without the orientation of a solution concept; one cannot first understand, then solve.¹⁰ Disease, illness, technology, treatment, life: They come as a package, so it would be better to study them in this way.¹¹

A population-based screening program like BreastScreen Australia must be implemented with stronger control and guidance that is customary in health service development.¹² The number of regulations applied to healthcare need to be rationalized and reduced to remove the extensive compliance burdens placed on healthcare organizations.¹³

This chapter provides the background to the research problem and research method; it points to the key concepts used in the analysis and the research findings.

1.1 Background

The problem of health service delivery is widely investigated, discussed and the focus of organised human activity all over the world. The World Health Organisation; national governments; public and private health care providers; academics; supporting industries and citizens devote intellectual, social and technical resources to the issue of providing services that promote and enable the health and well-being of humans¹⁴.

Australia is a western country with an established health system that is under stress primarily due to ageing population and in need of transformation if it is to operate sustainably into the future. Information systems and information communication technologies (IS/ICT) are considered an essential component of any health care system transformation, but there are problems, and the failure rate of IS/ICT in health settings is very high due to the complexities of information use and requirements.

⁵ Gori, Mandar (10th October, 2007): <http://www.myehealth.blogspot.com/> accessed 16/02/2009

⁶ (Heeks, Mundy, & Salazar, 1999)

⁷ (Nemeth & Cook, 2005)

⁸ (Tan, 2005b: 51)

⁹ (Rittel & Weber, 1973: 165)

¹⁰ (Rittel & Weber, 1973: 162)

¹¹ (Mol, 2006: 412)

¹² *National Accreditation Standards BreastScreen Australia Quality Improvement Program* (National Quality Management Committee, 2002).

¹³ (Scrivens, 2007: 76).

¹⁴ This ambit claim is based on the plethora of information devoted to 'health' available on the Internet and in print media. Other assertions / generalisations in this section are discussed and supported in the literature review (Chapter 2).

BST delivers breast screening and assessment services to Tasmanian women within a national quality assurance Program for accrediting service organisations, BreastScreen Australia (BSA). Its client demographic is women aged over forty, targeting the 50-69 years age range; it is heavily dependent on its computer information system and has troubles attracting and retaining qualified staff members.

In 2005, BST attained the highest level of accreditation available to an organisation within the BSA Program. Within the first weeks of field research, the researcher noted actions to protect its reputation as a high quality health service that is patient-centred in its care delivery. Its status as Tasmania's "only accredited breast screening service" was founded on IS/ICT-enabled proof of compliance against 176 National Accreditation Standards (NAS) and accreditation is a condition for Federal government funding. Its reputation was promoted within Tasmania by community education and affected by positive or negative experiences of individual clients.

The purpose of BST is to reduce mortality and morbidity from breast cancer. The premise is that women's lives will be cost-effectively saved by a population health service program of routine screening 'well women' (no symptoms) with follow-up further assessment by a multi-disciplinary team of clinical specialists, if needed. Participation in the breast-screen program is psychologically difficult because the outcome can be that an implicit threat of death by cancer is made explicit. A priority of the Program is providing clients with timely and appropriate information in order to mitigate the potential for clients to experience the clinics as a series of potentially painful and frightening clinical procedures (BreastScreen Australia, 2005).

Clients of BST interact with a number of staff members acting in different roles. A paper client record provides the main information support for clinic work. The clinicians in the team use it to record the outputs of their work activities. In the assessment clinic, the client record is used to discuss the meaning and significance of the data for a definitive diagnosis. The counsellors and a senior medical clinician from the team, use the breast x-ray component of the client record to show, explain and discuss the meaning and significance of the diagnostic data to a client. The counsellor role is to ensure explanations and recommendations align with principles of patient-centred care for a woman experiencing the threat of death by cancer.

As soon as work is completed for each clinic, the batch of client records is then relocated to a data area. The data from each client record is manually entered onto a client information system database. The client information system provides some automated information support for the work of the clinics. It is used to print appointment lists and client identity labels for the paper client record; it automatically generates letters to clients (appointment invitations; results). However, the primary use of the client information system is for manipulating client data, not to support patient care, but to generate data reports on how the BST organisation meets the 176 NAS stipulated by the accrediting organisation, BSA.

NAS data reports are very important in BST, yet none of the medical practitioners/clinicians who work for BST are accredited by the NAS. To be employed, each clinician undergoes a "credentialling" process to check that they have the requisite skills and knowledge. Evidence is required of membership of the professional

organisation for their clinical specialty and of ongoing learning and development of their professional practice.

This tension between organisation accreditation and clinician practice mirrors a larger tension in health between different models for assuring health care quality. The tensions are evident between conflicting values and principles embedded in evidence-based medicine (EBM) and patient-centred medicine; standardised clinical guidelines for practice and clinical autonomy with social forms of accountability as a mechanism and motivator for quality improvement. All perspectives interacting in this 'health system conflict' advocate using IS/ICT as a necessary element of any arrangements for information support.

The tensions are exacerbated by a health 'crisis' in which ageing population and issues of sustainability create pressure on clinicians to change their work practices and in which IS/ICT is promoted as a mechanism of critical importance to support health service delivery that is safe and high quality. EBM principles are promoted for both performance measurement and development of individual clinician 'best practice.' IS/ICT can provide data processing power for information to hold health service providers accountable for their care delivery practices as well as enabling them to be more efficient and effective in caring for clients¹⁵.

Better information support is clearly needed in health and well-integrated information systems are a sensible, even obvious, objective to have from a technical viewpoint. However, the conflicting principles and models for assuring health care quality and safety and different roles perceived for IS/ICT in health services mean that the fundamental problem for health is not simply a matter of IS design to provide 'the right information, in the right place, at the right time' (*origin unknown*). In addition, qualitative socio-technical research approaches have been utilised in IS research as a means of documenting and analysing complex problems involving IS/ICT in rich, complex social domains such as health service organisations. However, translating social insights for technical implications and purposes is problematic (Kelder & Turner, 2005a, 2005c).

Thus, the provision of information support systems (sometimes referred to as 'e-health') for health service settings is a wicked problem type (Rittel, 1984 [1972]) and sits between many tensions of competing and opposing forces that operate in health service delivery domains. On wicked problems and the failure of systems engineering approaches, Rittel comments:

One cannot understand the problem without knowing about its context; one cannot meaningfully search for information without the orientation of a solution concept; one cannot first understand, then solve. ... Every wicked problem can be considered to be a symptom of another problem. Problems can be described as discrepancies between the state of affairs as it is and the state as it ought to be (Rittel & Weber, 1973: 162, 165).

Concepts such as Rittel's 'wicked problems' point to the need to approach IS research as a process of inquiry that takes place over time and is open to a range of theoretical

¹⁵ See Section 2.2.2 and 2.2.3.

frameworks and techniques rather than goal-directed solving a well-defined problem. A process inquiry approach involves iterative reconceptualising the problem situation and incremental partial design solutions with emergent properties (Checkland & Scholes, 1999; Gasson, 2003). Systems concepts are used to stimulate and structure debate about the nature of a problem to help structure thinking and learning about a complex real-world situation, rather than seeking to objectively model a situation as a system (Rosenhead & Mingers, 2001).

1.2 Research Problem

Three areas of concern that contribute to ‘wicked problem’ characteristics of researching the health service delivery operations of BST include:

- 1) a ‘health crisis’ in which the ageing population and generational change acts as a driver for an ‘e-health vision’ of increasing the deployment of IS/ICT (intended to increase health service organisations’ capacity to sustainably deliver high quality health services into the future);
- 2) a ‘health system conflict’ between population-based medicine and individual-based medicine in which population-level data and the principles of EBM, information integration and work practice standardisation are important elements of a vision for high quality, cost-effective health services but are philosophically in conflict with situation-based culturally competent medical practice that values clinician expertise and individual clinician autonomy;
- 3) a ‘human centred’ vision, encompassing patient-centred care, human centred computing and human centred research, which considers the role and impact of information and information systems in health service contexts and the consequences of embedding principles of information integration and work practice standardisation into client records and, more widely, organisation design.

This research first considered a methodological issue arising from the properties of the research domain and insights from IS and socio-technical research literature:

Methodological Issue

How do we scientifically study, understand, analyse and develop new information systems (IS) for wicked problem domains (especially in health)?

The research method proposed was a human-centred, multi-method three-phase approach to understanding and analysing the BST situation. The method identified a problem specific to the BST situation: a *nexus between accreditation and practice*. This nexus is not explored in IS literature and the research method was to then develop conceptual models for analysing the nexus.

The primary research question was a response to IS discipline concerns to understand the inter-relationships between how people cooperate and coordinate together in shared activities and the information support required to facilitate and enable them to achieve the purpose of the activity. The role of an information system and its impact are key aspects in any human activity. Secondary research questions were developed

as the endpoint of critical reflection activities in each phase in the method, and in response to the findings out of phases one and two in which the problem theme of a *nexus between accreditation and practice* was identified.

Primary Research Question

1. What is the role of the information system in the functioning of a breast screening and assessment health service in Tasmania and what is its impact?

Secondary Questions

2. What is the role and impact of the client record on accrediting breast screening and assessment services in Tasmania and in supporting decisions of individual clinicians and individual patients/clients?
3. How does the information system (organised information support provided for the setting) impact on the roles and interactions amongst professionals (recruitment, administration, management, data and clinical) working in BST?

The objective of the second question was to understand a key technical element of the information system – the *client record* – in relation to the two activities related by the *nexus*: accrediting BST health service delivery and supporting the decision-making activities by clinicians and clients in the clinics.

The objective of the third question was to understand the broader context for the organisation of the information support arrangements for all its activities. The aim was to understand the impact of collecting and using client data for organisation-level accreditation and supporting interactions that occur in the course of individual and team-level health service practice. This perspective of ‘information system,’ derived from SSM, includes social elements in the ‘information system’ construct in addition to technical elements such as the client record and client information system artefacts.

1.3 Key Concepts

The research method builds on insights from research literature that adopt human-centred perspectives when discussing IS/ICT in organisation settings. *Human centred computing* is an important principle in approaches to IS/ICT design and implementation. *Human centred research* is important to researchers investigating the effects of technical structures and artefacts on people and societies. Many research methodologies focus on the interactions between social and technical aspects of human activities and the consequences and implications for human actors in a setting. In the healthcare domain this focus is captured by the term *patient-centred care*.

The research is a three-phase, iterative approach to data collection and analysis. Soft Systems Methodology (SSM) is the conceptual framework for the research process. The method draws on principles and techniques associated with SSM and Grounded Theory Methodology (GTM). It uses a construct synthesised from different analytical frameworks in the literature, ‘people, place and things’ (PPT), as a heuristic device. The PPT-construct guides the researcher’s thinking about an organisation setting in terms of dynamically changing configurations of interacting people, place and things. It is used to keep the unit of analysis flexible during cycles of data collection and to prompt utilising a range of theoretical frameworks to provide different perspectives for structuring the data (Section 2.5.1).

The research method produced two artefacts that provide the conceptual framework and structure for the research process. They are presented as two tables and are used in the thesis to show how the research was conducted and shape its discussion.

1.3.1 Research Method Artefact: Table 3-1

Table 3-1 is the method that guides the research process and provides the structure for a systematic investigation of an organisation as a wicked problem domain.

Each phase of the research has a focus and set of related activities with a desired analytic outcome: 1) problem appreciation, 2) theme identification and 3) conceptual models. Data collection and analysis techniques for a phase align to the focus of that phase.

The PPT construct is a heuristic device used in each phase to keep the data collection and analysis process open. It is particularly important in phase one data collection to generate a rich data set and in phase two to provide a range of analytic perspectives and insights for understanding and analysing the data. In phase three different PPT-frameworks are a source of constructs and relations that can be incorporated into conceptual models.

What is the role of the information system in the functioning of a breast screening and assessment service in Tasmania and what is its impact?		
Method		Results
Research Process	Techniques	Analysis Outcomes
Phase One: familiarisation and sense-making Activities <ul style="list-style-type: none"> generating a data set; documenting PPT trajectories; describing activities; drawing rich pictures critically reflecting on key elements, relationships and perspectives. 	Data Collection Field data; PPT-trajectory. Data Analysis Trajectory mapping; Rich picture construction Focus questions	Structured Data Products Problem situation appreciation (table 4-1) leading to → phase two
Phase Two: identifying a problem theme Activities <ul style="list-style-type: none"> identifying problem stories; mapping PPT constructs; critically reflecting on the problems; selecting a key problem theme for further investigation. 	Data Collection Field data; Semi-structured interviews. Data Analysis PPT constructs map onto rich pictures; Focus questions; Assess evidence for problem theme selection;	Structured Data Products Problem theme identification (table 4-1) leading to → phase three
Phase Three: conceptualising a theme Activities <ul style="list-style-type: none"> researching key terms; conceptual modelling; testing conceptual models critically reflecting in relation to model development 	Data Collection Validation/ disconfirmation field data (organisation documents, email questions); Data Analysis Qualitative modelling (constructs and relationships); IS modelling (data, process views); Focus questions	Structured Data Products Theme conceptualisation (table 4-1) leading to → Interpretation and Discussion (table 4-1 and table 5-1)

Table 3-1

1.3.2 Research Method Artefact: Table 4-1

Table 4-1 shows the data products of the research activities out of each phase of the method. Each phase has a different focus (problem situation appreciation, theme identification, theme conceptualisation) that orients the data analysis. Different data analysis techniques produce different ways of structuring the data from different perspectives. The research process uses critical reflection as a technique to aid transition to the next phase: constructs, relations, perspectives and any assumptions

are challenged until no new perspectives or patterns appear in the data. Transition to the next phase is via a concluding analysis that is the foundation for the next phase.

What is the role of the information system in the functioning of a breast screening and assessment service in Tasmania and what is its impact?		
METHOD	RESULTS	
Research Phase	Structured Data Products	Analysis concluding a phase
Phase One: familiarisation and sense-making Activities <ul style="list-style-type: none"> • generating a data set; • documenting PPT trajectories; • describing activities; • drawing rich pictures • critically reflecting on key elements, relationships and perspectives. 	<ol style="list-style-type: none"> 1. Rich pictures 2. Work Flows and Data flows 3. Systems views of BST (social, technical): organisation and client perspectives 	Problem Situation Appreciation Key elements; relationships; perspectives Leading to → phase two
Phase Two: identifying a problem theme Activities <ul style="list-style-type: none"> • identifying problem stories; • mapping PPT constructs; • critically reflecting on the problems; • selecting a problem theme for further investigation. 	<ol style="list-style-type: none"> 1. Constructs and relationships (grounded in data; adopted from PPT-theoretical frameworks) 2. Theme: nexus between accreditation and practice. 	Problem Theme Identification Problem theme Leading to → phase three
Phase Three: conceptualising a theme Activities <ul style="list-style-type: none"> • researching key terms; • conceptual modelling; • testing conceptual models • critically reflecting in relation to model development. 	<ol style="list-style-type: none"> 1. Theme description and construct articulation 2. Model one: nexus between accreditation and practice 3. Test → DFD and E-R diagrams for IS artefact 4. Model two: information orientations for an integrated client record; Boundary maintenance construct 	Theme Conceptualisation Conceptual models; meaning of the <i>nexus</i> Leading to → Interpretation Models interpreted to answer research questions and consider implications for IS design Discussion <ul style="list-style-type: none"> • Health Service delivery and accreditation • Information integration and work practice standardisation • IS research and socio-technical perspectives

Table 4-1

1.3.3 Conceptual Models

The findings of the research are presented as two conceptual models, developed using the research theme, *a nexus between accreditation and practice* as a lens. The models are briefly presented in this section and also two constructs derived from the empirical data: *institutional broker* and *boundary maintenance*.

Model one (Figure 1-1) represents the *nexus between accreditation and practice* as experienced by the Service organisation, BST. Model two (Figure 1-2) represents the tension embedded in a client record designed to provide data oriented for both population-level and individual situation use and the human activity required to maintain the meaning of data across different contexts of use.

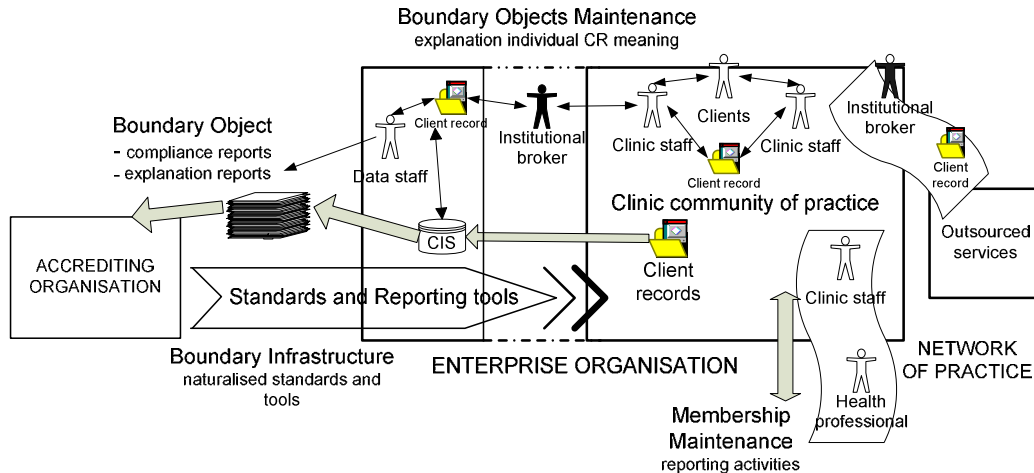


Figure 1-1 Model one: Nexus between Accreditation and Practice

Model one highlights key elements of the *nexus between accreditation and practice* embedded in the design of the technical elements in the BST information system, particularly the client record (paper) and electronic client information system ('CIS'), to comply with the BSA accrediting requirements (Kelder & Turner, 2008).

BST is a health service organisation engaged in the enterprise of screening women for breast cancer. Accreditation of an 'Enterprise Organisation' is an artefact construction: measuring performance from client record data. The paper client record is used to record data collected from clients in the clinics and then entered on the client information system where it can be processed for organisation accreditation purposes. Accreditation of individual staff members is primarily socially constructed via membership and multi-membership of professional practices (*community of practice*, professional *network of practice*) and brokering roles, in particular the *institutional broker* role.

At the organisation-level unit of analysis, **institutional broker** is a leadership role, formally instituted within the organisation design for ensuring work practice conforms to accreditation standards of clinical best practice.

Within the community of practice the role is both leading by example and enforcing standards for practice based on institutional authority.

Within the network of practice, the role carries no institutional authority and brokering is by education and persuasion.

The client record and client information system artefacts also function as *boundary objects* and are the tools and focus of *boundary maintenance* activity. Data reports are

used internally by BST to measure and monitor organisation activities and also evaluate organisation performance against accreditation standards. Evaluation for accreditation is done by the accrediting organisation, based on compliance reports and explanation reports constructed by the enterprise organisation.

Boundary maintenance enables meeting differing requirements for data collection and interpretation (regarding the form, structure or meaning of data) in the context of multi-use of data or information.

At the organisation-level unit of analysis, **boundary maintenance** is the human activity of creating and maintaining information support connections across organisation boundaries (within-organisation and inter-organisation) to achieve agreed objectives where the information orientations for different social domains are dissonant.

Some boundary objects have been naturalised into the organisation everyday practice and function as *boundary infrastructure*. The standards and reporting tools (templates) are provided by the accrediting organisation and mandated for use by all service organisations in the Program.

Model two (Figure 1-2) highlights that the client record (paper and electronic) is fully integrated to provide data that can be oriented to three different purposes: evidence of organisation performance, professional clinical judgment and client decision-making. It illustrates the tension between the three information orientations and that boundary maintenance activities by BST staff are required to manage the differences in meaning for each orientation. It also highlights that the three orientations are connected to each other and interdependent.

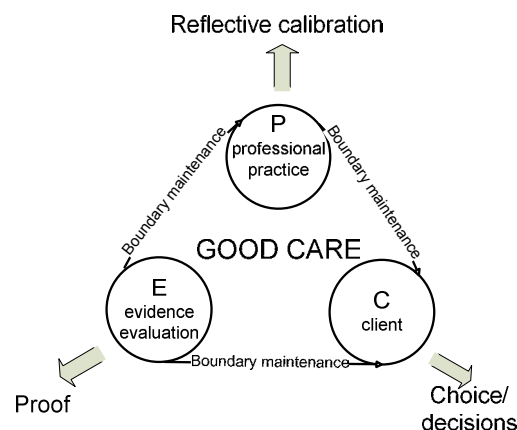


Figure 1-2 Model two: Information Orientations in Client Care Decisions and Evaluation

One outcome of population-level client data is an evidence-base for professional clinicians for clinical decision-making: clinical guidelines of the benefit to client/patients of a particular clinical intervention. Clinicians calibrate the medical professional evidence-base in the clinic context to account for each individual client situation. The process is internal reflection and/or multi-disciplinary discussion leading to diagnosis and recommendations. Client data contextualised by evidence-based medical knowledge is further calibrated and adjusted into a form suitable for

informing and discussing the results of professional decision-making with the client/patient.

The client is provided the professional judgment of their individual situation by a clinical professional who also contextualises the significance and implications (meaning) of the client's situation by referring to population-level evidence-oriented data applicable to their diagnosis.

At the individual-level unit of analysis, the activity of translating meaning between information orientations and calibrating decisions based on judgment of the relative significance and applicability is **boundary maintenance**.

The client record data is the basis of organisation performance evaluation for accreditation (Figure 1-1). In the context of organisation performance and the meaning of the client record, the institutional broker role is boundary maintenance. The boundary maintenance activity takes the form of explanation and justification or changing practice in response to evidence that standards have not been met. Meaning maintenance is between professional practice-oriented use of the client record data and evidence evaluation-oriented use.

The research findings for the BST setting are interpreted and discussed in Chapter 5 as summarised by the table below (Table 5-1).

<i>What is the role of the information system in the functioning of a breast screening and assessment service in Tasmania and what is its impact?</i>		
Conceptual perspective: <i>findings</i>	Research Questions: <i>understanding</i>	Contextual perspective: <i>related literature</i>
<i>Meaning of the Nexus Information System</i> <ul style="list-style-type: none"> • two forms of accreditation; • measurement and membership requirements in tension; <i>Client Record</i> <ul style="list-style-type: none"> • information orientation requirements in tension; <i>Roles and Interactions</i> <ul style="list-style-type: none"> • specific role and activity required in relation to client record data. 	<ul style="list-style-type: none"> • Role and impact of information system • Role and impact of client record on accrediting health service and on supporting clinician and client decision-making • Information system impact on roles and interactions amongst professionals working in BST 	<i>Discussion</i> <ul style="list-style-type: none"> • BST and the health system crisis • BST and the health system conflict <i>Commentary</i> <ul style="list-style-type: none"> • health service delivery and health service accreditation • information integration and work practice standardisation • IS research and socio-technical perspectives

Table 5-1

The research places BST as a health service delivery organisation designed to solve the problem of how to save Australian women from dying of breast cancer cost-effectively, to high quality. The solution formulated more than ten years ago – a national Program incorporating the principles of standardised work practices and integrated information enabled by IS/ICT – has demonstrably achieved its goal according to the criteria.

However, the BSA accrediting arrangements that combine ‘strong control’ with self-assessment and peer review (National Quality Management Review Committee, 2002) has wicked problem effects. These in turn have implications for how we design IS for a future dominated by ageing population and the possibility that IS/ICT to monitor and control organisations places stress on the health practitioners/ clinicians. Maintaining individual Service delivery productivity may not be sustainable into the future due to negative social impacts on staff members under pressure to work more efficiently and against their professional identity and values.

Thus, this research has implications for the role of IS/ICT in health service delivery and accreditation, including assumptions on the benefits of information integration and work practice standardisation. IS design can readily embed principles and work processes that align with measuring standardised work by population-level data for health service quality assurance. However, the wicked problem characteristics affecting health services means that IS that prioritises population-level data-oriented accrediting models can fail to provide information to support social information interactions, including how work is measured for quality within professional memberships. In addition, providing an information system to monitor performance is important, but IS/ICT is also needed to effectively support health service practitioners and clients in making decisions and to provide feedback on individual performance.

1.4 Chapters Summary

This research has been introduced as a human-centred, multi-method approach for scientific study of wicked problem domains, developed and applied in a single research setting: a population health breast screening and assessment service organisation, BST. The method was applied to identify, understand and analyse a problem situation for BST associated with the role and impact of its information support system. The chapter set out broad ‘wicked problem’ characteristics of the research setting and concerns that led to the research questions; identified the key concepts used in the analysis and briefly presented the research findings.

Chapter 2 presents the literature that informed the research method and interpretation of the findings: the contextual background to researching the BST situation; the conceptual background for the method and the concepts drawn from socio-technical literature and used in the conceptual models developed in phase three.

Chapter 3 presents a human-centred, multi-method, multi-phase approach to a wicked problem, showing how understanding a problem situation emerges and the problem is then studied. Table 3-1 is an artefact from the research that provides the method for structuring the scientific process.

Chapter 4 presents the data and analysis generated from the research approach. In particular, Table 4-1 is a research artefact setting out the products of the analysis (structured data) for each phase. The chapter presents a range of artefacts that are the products of the research analysis (some of which have potential for use in other research domains). Two conceptual models are presented for analysing a *nexus between accreditation and practice*.

Chapter 5 interprets the *nexus* and the conceptual models for the substantive BST problem situation. It uses them to interpret the findings in relation to the research questions. It then discusses the research findings for BST for the broader context of issues identified in the literature review related to health service delivery and information service provision to support service delivery work practices.

Chapter 6 presents the contributions of the research (substantive, methodological and theoretical). It discusses the utility of the research method and products of the analysis for IS research, utilises the conceptual models to discuss possible transformations to the *nexus* and discusses future research directions.

CHAPTER TWO – LITERATURE REVIEW

CHAPTER 2 LITERATURE REVIEW

The previous chapter introduced a methodological issue of how to scientifically study, understand, analyse and develop information system support for the sorts of wicked problem domains evident in health service delivery. The proposed approach was a multi-phase, multi-method approach to understanding and analysing BST. The method identified a specific problem for the research setting, BST, as a *nexus between organisation accreditation and individual practice*. The chapter briefly presented two artefacts of the research method and the two conceptual models developed to analyse the *nexus*.

This chapter presents the literature that informed the research. The research context is health care service delivery with wicked problem properties, particularly in relation to information support systems and the role of IS/ICT. Table 2-1 sets out the literature that informed the research. It highlights key aspects of the research setting context and the conceptual background that informed the method and provided constructs utilised in the conceptual models, structured around the major themes identified from the literature review.

CHAPTER TWO OUTLINE

Section 2.1 is an overview of the literature domains informing the research context, research method and interpretation of the findings.

Section 2.2 presents the contextual background for IS research in a health service delivery setting with the properties of a wicked problem domain, aligned to the theme of a human-centred vision for the future. This includes an overview of the formal meaning of accreditation of health professionals and health service organisations, investigated in response to the research outcomes of Phases one and two.

Section 2.3 provides the conceptual background for human centred approaches in Information Systems and socio-technical research suitable for exploring or investigating an organisation situation with wicked properties.

Section 2.4 analyses three socio-technical theoretical frameworks and synthesises ‘people, place and thing’ (PPT) as a construct for use as a heuristic device to keep the research process open in both data collection and analysis.

Section 2.5 presents the key concepts used in the research analysis that were important in developing models in phase three of the research.

Section 2.6 summarises the outcomes of the literature review in terms of its implications for the research method and the conceptual models developed from the analysis.

2.1 Introduction

This research sits at the intersection of problems related to provision of information support and the role and impact of IS/ICT on organisation work practices across three broad domains:

1. health care service delivery and the role of IS/ICT (e-health);
2. IS research approaches for organisation settings;
3. socio-technical research approaches suitable for understanding complex situations ('ill-structured' or 'wicked' problems) in organisations.

The research draws on literature from the three domains that have a human-centred focus when discussing IS/ICT in organisation settings. *Human centred computing* is an important principle in approaches to IS/ICT design and implementation. *Human centred research* is important to researchers investigating the effects of technical structures and artefacts on people and societies (Gasson, 2003). Many research methodologies focus on the interactions between social and technical aspects of human activities and the consequences and implications for human actors in a setting (Bowker & Star, 2000). In the healthcare domain this focus is captured by the term *patient-centred care* (Berwick, 2002).

The research method aims to address key challenges identified in this literature and build on insights from a range of approaches presented in IS and socio-technical literature. Human-centred approaches in Information Systems take a socio-technical view of an organisation situation. Human-centred computing explicitly resists prioritising technical perspectives and solutions over addressing social system issues (Gasson, 2003).

Concepts such as Rittel's (1984 [1972]) 'wicked problems' and his views on the reasons for the failure of systems engineering approaches point to the need to design research as a process of inquiry that takes place over time and is open to a range of theoretical frameworks and techniques. Deterministic approaches to problem definition in IS have been criticised on the grounds that even ostensibly user-centred approaches for information systems design have a tendency to precipitate closing down problem definition and to apply technology-centred methods for eliciting requirements (Gasson, 2003; Kelder & Turner, 2007). Human centred computing is facilitated by a process inquiry approach to allow the users of any information system design to have ongoing input into problem definition and information requirements of IS/ICT supporting their work (Gasson, 2003).

Socio-technical approaches are very important in health informatics to improve system design and evaluation (Berg, Aarts, & van der Lei, 2003). Socio-technical research has highlighted the consequences of technology on the vulnerable and those marginalised by the assumptions embedded in IS/ICT design (Bowker & Star, 2000). For example, IS/ICT can be used as a tool for standardising guidelines advising clinical practices and monitoring compliance as well as a site of resistance to control and struggle for autonomy and self-regulation of work (Larsen, 2005).

Socio-technical theoretical frameworks facilitate capturing the situated and dynamic nature of human activities: the social, political and cultural elements of technologies and the interactions involving people, place and things over time (Kelder & Turner, 2008). This research draws on socio-technical literature to identify theoretical frameworks and constructs useful to study, understand and analyse wicked problem situations. They can be used heuristically as a range of lenses to inform and develop conceptual models that can be used to think about new ways of organising the provision of information systems to support human activity.

Literature domain	Contextual Background	Conceptual Background		Key literature
Health domain Issues and approaches in the delivery of health care services + role of IS/ICT	e-health vision – patient/client information supported by integrated IS/ICT Health services provision sustainable, evidence based and patient centred. → Information Integration and work practice standardisation is complex and difficult in health	<ul style="list-style-type: none"> Information Integration and Work Practice Standardisation creating sets of ‘wicked’ problems in health service sector individual patient care and population-level care evidence-based medicine; clinical guidelines for practice cultural competence in medicine; clinician autonomy 	People Place Thing (PPT) construct heuristic device ‘Human centred’ focus	(Timmermans & Berg, 2003) (Editorial, 2006) (Wilson, Baines, Cornford, & Martin, 2007) (BreastScreen Australia, 2005) (Braithwaite et al., 2006)
Accreditation of health care service organisations	High quality, cost-effective service vision – accrediting systems evidence base for continual quality improvement and cost-effectiveness. → information integration and work practice standardisation key to accreditation systems	<ul style="list-style-type: none"> Models for quality assurance of health services Accreditation, quality and safety Accrediting systems; continuous quality improvement 		
Information Systems Issues and approaches for understanding IS/ICT in organisations	‘Information society’ vision – information integration and associated work practice standardisation across multiple organisation contexts. → IS/ICT role part of ‘wicked’ problems in health service domain	Concept of ‘ill-structured’ or ‘wicked problems’ → problem structuring methods and process approach Process inquiry approach – Soft Systems Methodology (SSM) as conceptual framework <ul style="list-style-type: none"> Techniques for data generation and analysis Constructs for describing effects of IS/ICT in organisations 		(Checkland & Holwell, 1998) (Gasson, 2008) (Rittel, 1984 [1972]) (Gasson, 2003)
Socio-technical research Issues and approaches to understanding socio-technical situations	Research vision – identifying the consequences of work practice standardisation and information integration for humans. → IS discipline adoption of GTM techniques and frameworks for understanding organisation information and work practice systems	Process-inquiry approach – grounded theory methodology (GTM) principles <ul style="list-style-type: none"> techniques for data generation and analysis constructs for perspectives on technology purpose, use, effects theoretical frames applied as lenses to generate insight (DCog, COP, AT) Other constructs and theoretical frameworks 		(Hutchins, 1995a) (Engeström, 1999) (Wenger, 1998) (Bowker & Star, 2000)

Table 2-1 Literature Review – Thematic Relationships Overview

2.2 Contextual Background – Health Service and IS/ICT

The context of this research is health service delivery and the role of IS/ICT as a wicked problem domain. Threats to the sustainability of Australian health care services include forces and pressures due to an ageing population; tensions between competing models for quality health service delivery and the different roles of IS/ICT as part of ‘e-health’ solutions for assuring high quality, sustainable health care delivery into the future. Different models for health service delivery have competing perspectives that prioritise IS/ICT information to support individual situation decision-making (medical practitioners and clients) for patient-centred care or to collect and manipulate population-level data, which is the evidence base of clinical guidelines.

2.2.1 Visions for Health Services and IS/ICT

Three streams of literature intersect this research: each with a vision, aligned to human-centred aspirations, to contribute to improved experiences for people requiring healthcare services.

E-HEALTH VISION – HEALTH SERVICE DELIVERY

A motivation and rationale for e-health is that the current systems for delivering health services in western countries need major restructuring to reliably ensure patient safety and quality care at reasonable cost (Tan, 2005b). There are different perspectives on the value of e-health and the purpose, but in common is a reliance of IS/ICT, and the provision of information, to transform the way health care is delivered.

For Berwick (a clinician with personal experience of failings of health care services) radical rethinking of health care involves a different view of information from the current model where “information is treated generally as a tool for retrospection, a record of what has happened” to a model of health care service that incorporates the concept that “Information ... *is* care” (Berwick, 2002: 44). Tan, editor of *E-Health Care Information Systems* (Tan, 2005a), claimed, “the e-health vision ... leads to more secure and improved sharing of health care data and records for efficient and effective health care delivery and the promotion of citizens’ well-being (Tan, 2005b: 41).

Sustainable and efficient health services are characterised by standardised work practices and fully integrated information systems (Australian Health Information Council, 2007). The envisaged effects of IS/ICT (e-health systems) are both driver and enabler of change:

EHealth offers the opportunity to transform an unsustainable healthcare system and can be both an enabler of health care models and a driver of health care system reform. Accordingly eHealth can be a critical intervention point generating a sense of urgency to bring about the desired changes in the system (Australian Health Information Council, 2007: 18).

‘INFORMATION SOCIETY’ VISION – INFORMATION AND WORK IN HEALTH

IS/ICT enabled *information integration* and *work practice standardisation* are important concepts in debates about how to deliver improved efficiency and effectiveness, transparency and the appropriate mix of private and public sector healthcare provision

(Le Grand, 2000). The burgeoning capabilities ICTs for information integration create opportunities in designing organisation information systems and work practice systems to increase efficiency and effectiveness of health service professionals and organisations (Wilson et al., 2007). Standardisation technologies enable information and activity integration across different contexts (Timmermans & Berg, 2003). Health information systems can be deployed to collect and enable analysis of information on the extent and effectiveness of health interventions as a critical input to guide decisions (Shengelia, Tandon, Adams, & Murray, 2005).

Information integration means that data can be used across boundaries within and between organisations and reduce fragmentation of patient care. It is linked to the ambition for work practice standardisation in health services to ensure high quality, evidence-based care of patients (Timmermans & Berg, 2003). The transformation from fragmented to integrated data sources (information integration) requires a degree of work practice standardisation to join up work activities from multiple local contexts across an organisation or between organisations (Wilson et al., 2007).

The incorporation of IS/ICT into health care service contexts is problematic and e-health systems have a high failure rate (Heeks et al., 1999). Barriers to an e-health vision for IS/ICT-enabled health services that are economically sustainable, high quality, equitable and accessible health care are social, political, historical, legal and cultural as well as technical (Tan, 2005b).

RESEARCH VISION – IDENTIFYING CONSEQUENCES FOR HUMANS

The nature of health service delivery is *ad hoc* and focused on services to individual clients, which does not easily align to the formal, standardised requirements of information systems (Berg, 1999). IS/ICT-enabled classification and data collection opens up possibilities for surveillance and control, which can cause distress to individuals and marginalised groups (Bowker & Star, 2000; Star, 1995; Star & Strauss, 1999) and is resisted by clinicians concerned about erosion of professional clinical autonomy (Timmermans & Berg, 2003).

Modern management practices that use IS/ICT-enabled information flows to increase workload and control of health care workers can create a situation of information overload and associated stress symptoms, including defensive behaviour (Wilson, 2001) and defensive culture burdened by excessive documentation (Cooke, 2006).

‘Information overload’ is phenomenon with significant negative effects including time wasting, delayed decision-making, distraction and stress (Wilson, 2001). Eppler and Mengis’s (2004) concept review of information overload highlights the “reciprocal effects of technological, personal, information-based, task-oriented, and organizational changes” (p. 342) in contributing to an information overload situation. Negative impacts in performance health service contexts and safety of patients can also occur when data generated from work practices is used to control workers and limit or remove opportunities for discretionary work (Westrum, 2004).

2.2.2 Wicked Problems in Health

Literature discussing the challenges and benefits of IS/ICT indicates that proposals to realise efficiency, effectiveness and increased quality of patient care via IS/ICT has the properties of a 'wicked' problem (Clarke & Stewart, 2000; Rittel, 1984 [1972]).

Discourses on the need for health system transformation are characterised by crisis and conflict.

HEALTH IN CRISIS: IS/ICT AND SUSTAINABILITY

Sustainability of health service delivery due to ageing populations and advances in medical knowledge and technologies are at the forefront of most political and policy agendas (Alvarez, 2005; Caro, 2005; Oliver et al., 2001). E-health initiatives have been identified as critical to respond to the crisis (Pagliari et al., 2005).

E-health and health system transformation discussions concentrate on the need to provide information to: 1) support health services practitioners in the conduct of their work (Winthereik & Vikkelsø, 2005); 2) measure health services practice for quality assurance (Clarke, 2003) and 3) support health service clients in making decisions related to their physical well-being (Adams & de Bont, 2007; Suggs, 2006).

However, the "tribal" characteristics of relationships between health service professionals (strong professional identities and loyalties; hierarchies and 'turf protection' activities) is an apparently intractable problem and barrier to health service reform (Braithwaite, 2005) both in terms of redesigning work processes and providing ICT-based information support.

HEALTH CONFLICT: MODELS ASSURING QUALITY AND SAFETY

The role of regulatory frameworks for controlling how organisations conduct their enterprises and community has a long history, including the area of health service provision. McEachern's (1934) call for a national mandate for public health service that provided control, coordination and correlation, standards and accreditation for education and practice of health professionals in concert with public education has been largely realised. However, nearly eighty years later, research indicates problems emerging from forces for management and regulation of services and service providers (Abma & Noordegraaf, 2003; Cooke, 2006) as well as the benefits of regulation and measurement of professionals providing proof of the quality of services (Kuhlmann, 2006).

ICTs have an integral role in quality assurance of health services: they enable collecting and managing vast quantities of data onto digital information systems and interrogation of the system to evaluate an organisation's compliance to the standards (Clarke, 2003). They are a critical component of every approach proposed for improving the health system (Grol, 2001).

In particular, preventative care and population health services are intrinsically suited to IS/ICT efficiencies due to the large scale and repetitious nature of work such as screening for cancer (Bar-Yam, 2006). In fact, the emergence "of automated information systems and the need for public health entities to manage large volumes of data and information were a perfectly timed match" (Lumpkin, 2003: 27).

However, information relevant to health care decision-making is context sensitive and context dependent, a mix of formal and informal considerations with the result that information that matters in a health setting is fluid and subject to change (Moser & Law, 2006). ICTs that too rigidly define information flow and the possible uses to which clinical practice will put information can damage other forms of information flow in a health decision setting, the informal and unpredictable considerations about a patient's specific situation that are included in a situated process of simplification and identifying relevant boundaries:

The large ICT programmes in health care seek to make information flow in ways that are predictable and seamless. Unpredictability or turbulence are seen as problems. But here is the rub: unpredictability cannot be banished from health care. Clinical decision making is often, perhaps almost always, unpredictable (Moser & Law, 2006: 56).

Health service organisations and health professionals who work for them are increasingly subject to quality assurance processes and accreditation requirements (Braithwaite et al., 2006). Positively, institutional cooperation and compliance with evaluation requirements of its operations is strong in contexts when there is a strong link between compliance and funding (Segerholm, 2001). But recent research raises questions on whether the abundance of very costly accreditation processes delivers better health systems (Braithwaite et al., 2006) and little is known about whether they provide comparative measures of quality (Kerr et al., 2007). Scrivens' (2007) suggests a limited number of parameters should be used to assess health service organisations in order to not unduly burden them in demonstrating they meet quality requirements for health service delivery.

Different models for achieving patient-centred, high quality health care reflect tensions in health care service delivery (Editorial, 2006). EBM is focused on changing medical practice such that clinicians follow standard clinical guidelines in delivering health services (Timmermans & Berg, 2003). EBM is philosophically at odds with an approach that trains clinicians in cultural competence in medicine (CCM) and relies on clinician expertise and judgment, client by client (Editorial, 2006).

EBM is criticised as top down and failing to account for the complexity of real world clinical practice and contradicting the nature and practice of professionalism (Grol, 2001). However, self-regulated requirements for continuing medical education (CME) does not provide evidence of competence without some external systems for external assessment (Grol, 2001).

The hierarchy of evidence within the EBM approach to clinical practice (the 'gold standard' evidence is randomised control trials) can hinder use of other types of knowledge that are useful for treatment decisions that are tailored to individual clients (Mantzoukas, 2008). Mol (2006) challenges the adoption of clinical trials as the 'gold standard' for health care research, noting:

... however well clinical trials might be able to prove or disprove therapeutic claims, and however strong their credentials when it comes to seeking evidence, they have their limits when it comes to assuring good care (p. 406).

The notion of what constitutes 'good care' has been extended by socio-technical research to include the lived experience of patients (Mol, 2006). The nature of

professional health care is then more than following standardised principles for clinical decisions, it involves “creative calibrating of elements that make up a situation until somehow they fit – and work” (Mol, 2006: 411).

The concepts of profession and professionalism are increasingly applied in modern work life paradoxically just as the necessary conditions of professional practice (trust, discretion and competence) are being challenged, particularly in the health and education contexts of changes to funding, organisation and administration (Evetts, 2006). ‘Evidence-based practice’ is part of the performance-oriented culture in modern organisation life. It is considered good for society because decisions are more likely to be based on well-informed judgements, based on evaluations that fulfil the three purposes of: accountability; learning about process and learning about effects (Lewis, 2001).

The relationship between professional and client is also changing with power shifting from the producer of expert services to the consumer (Pfadenhauer, 2006). Client / patient trust is also an important issue in terms of the role of professionalism in building trust (Kuhlmann, 2006) and the relationship between professional governance systems and state regulatory control (Allsop, 2006).

While clinical professions have benefitted from standards and clinical guidelines they also are construed as “undermining clinical expertise and rendering the profession vulnerable to oversight, substitution and interference” (Timmermans & Berg, 2003: 84). Thus, the requirements of training, certification and accompanying responsibilities of individuals to demonstrate participation in continuing professional development are related to establishing and maintaining legitimacy to practice, and also to establishing means of controlling members of the profession (Evetts, 2006; Timmermans & Berg, 2003).

It is not clear whether the broad purpose of evaluation of improvement and learning is connected to decision making for improvement (Alexander, 2003). However, a framework for routine, integrated service evaluation that provides client outcome data to clinical staff members provides an effective evidence base to inform and improve practice (Lucock et al., 2003). Evidence based guidelines for clinical practice can change the behaviour of physicians when accompanied by education as an ongoing process that has practical and discussion elements based on research (March, 2006).

2.2.3 Accreditation

The literature reviewed for the first two phases of this research related to the regulation of health care services (provided by organisations and/or individual clinical professionals) in the context of the health system conflict on models for assuring quality health care. The conflict between evidence-based medicine and patient-centred care is reflected in the conflict between the value and use of population-level client/patient data and individual situation data generated in the course of health service provision. This section presents the literature survey conducted during Phase three of the research to investigate the meanings of accreditation for organisations, professions and individuals in the health context.

The need for systems to ensure the quality and safety of health care have been recognised for a long time (McEachern, 1934). However, the establishment of formal systems to provide ongoing accreditation of health service organisations and health service practitioners in Australia is a relatively recent phenomenon dating apparently from the early 1990's. Literature related to formally and systematically governing the quality of Australian health services is fragmented and scattered over Internet sites for professional associations and government agencies instituted to develop and provide governance for assuring the safety and quality of health care.

Health service accreditation in the Australian context is being developed as a national system that has legislative force. The need for a streamlined and harmonised accreditation system for health services is communicated using vocabulary associated with external control and accountability: 'legislation', 'regulation', 'mandatory implementation', 'standards' and statements on the need to establish "formal obligations to comply with accreditation requirements and consequences for non-compliance by health services through the use of regulatory mechanisms and clearly articulated sanctions and penalties for non-compliance" (Anon., 2008b).

The preoccupation with institutionalised accountability contrasts with literature that values critical reflection on theory and adaptation of practice to suit real world situations (Schön, 1983) and organisation designs that facilitate development and emergence of practice and includes individual participation and negotiation and self-defined regimes of accountability (Wenger, 1998).

The definition of accreditation developed by the Australian Council for Safety and Quality in Health ('the Council'), established in 2001, is representative of and demonstrates the assumption that an evidence base must underlie accredited status:

... accreditation is the granting of recognition for meeting designated standards for structure, processes and outcomes, where outcome is the status of an individual, group of people or population which is wholly attributable to an action, agent or circumstance (Anon., 2008a: 5).

In fact, 'accreditation' is a concept with its own 'best practice' frameworks and requirements. A report commissioned by the Council stated that accreditation processes should:

involve self assessment, an evaluation visit, trained peer reviewers or evaluation team, written or verbal report, an evaluation of the findings by the accrediting body and a response by the organisation to the findings to implement change or improvements to their operations (Matthews Pegg Consulting Pty Ltd, 2003).

The Safety and Quality agenda aligns with the National e-Health Transition Authority (<http://www.nehta.gov.au/>) agenda for integrated information systems supporting health practice to enable electronically collecting and securely exchanging health information between health care service providers: standardised data collection and interoperable systems is important for data sharing and bench-marking.

Requirements for accreditation are defined by each professional organisation of clinical practitioners, including minimum levels of competency-based standards for knowledge and skills and evidence of continuing professional development activities. The

following definition of ‘accreditation’ for a clinical practitioner is representative of those found on websites representing clinical professional organisations.

An accredited practitioner will have achieved a level of competence to enable them to accept the responsibilities of practising independently and be capable of performing the expected role of a practitioner in a sole practitioner situation. An accredited practitioner has either, successfully completed the [professional development year or equivalent] and received the Statement of Accreditation, [or specified equivalent demonstration of competence].¹⁶

A key consequence of professional status is trust that the practitioner is competent to practice their profession independently and to skilfully exercise judgement of the best application of their knowledge in a given situation.

2.2.4 Summary: Contextual Background

The philosophy of this research is human-centred. The context is health service delivery and the role of IS/ICT as a wicked problem domain. A health crisis of ageing population threatens the sustainability of future health services. Proposed solutions incorporate an e-health vision in which IS/ICT is a key component of any solution to assure health system sustainability and quality into the future. The assumption of the e-health vision is that well-integrated information and standardised work practices will result in increased safety, quality, efficiency and effectiveness. ICT-enabled data collection and reporting capabilities for accrediting health service provision is a critical tool for achieving this vision. However, this vision is contested in socio-technical literature that provides empirical evidence of negative consequences and failures of e-health and other information systems.

Perspectives on the role of IS/ICT and the value of information integration and associated work practice standardisation are in tension and compete. These competing perspectives interact with perspectives over most appropriate mechanisms for sustainable health care delivery and models for quality assuring health care services. IS/ICT (‘e-health systems’) are a contested solution for efficient and effective information support for patient-centred care. Evidence-based medicine relies on population-level data and clinical guidelines. EBM principles can compete with perspectives that prioritise providing information to support individual situation decision-making (medical practitioners and clients) for patient centred care.

2.3 Conceptual Background – Method

The conceptual background for the research method (Chapter 3) is ‘wicked’ or ill-structured problem spaces and process inquiry approaches: IS research approaches and socio-technical research approaches suited to studying complex social organisation situations (‘wicked’ properties) involving human activity and providing information to support activity.

¹⁶ Australian Institute of Radiography Professional Accreditation and Education Board “Competency Based Standards for the Accredited Practitioner” (2005): electronic source accessed 28/11/2005 http://www.air.asn.au/files/uploads/0710_CBS_Accredited_Practitioner_Nov2005.pdf

2.3.1 'Wicked' or 'ill-structured' problems

Rittel's (1984 [1972]) concept of 'wicked' is used to describe real world problems faced in designing forms of social organisation or information systems to support organised human activity (Rosenhead & Mingers, 2001). The term is used to conceptualise problems that are ill-structured, subject to contested formulation, dependent on individual perspectives, susceptible to changing form during analysis and to evolving in nature during solution processes (Rosenhead & Mingers, 2001).

'Wicked' problems are distinguished from 'tame' problems, for which "an exhaustive formulation can be stated containing all the information the problem-solver needs for understanding and solving the problem" (Rittel & Weber, 1973: 161). Rosenhead and Mingers (2001) claim that all organisation situations are subject to 'wicked' aspects and criticises approaches that fail to accommodate the ill-structured nature of real world problem situations.

Rittel and Weber list ten distinguishing properties of wicked problems in their discussion of social policy planning (1973) and these have been adopted and adapted in other literature. Thus, 'wicked problems' have been described as: "a system of problems with varying degrees of interaction between components ... often ill-defined and not clearly understood ... [with] technical, economic and political components" (Hutchinson, English, & Mughal, 2002: 258); are subjectively defined and have subjectively better or worse solutions (Gasson, 2005). Wicked problems are "messy" (Pidd, 2004), "apparently intractable" (Wilson et al., 2007) and require "collective puzzlement" (Durant & Legge, 2006). Wicked or ill-structured problems are managed, not solved; require holistic thinking and working across organisational or conceptual boundaries (Clarke & Stewart, 2000).

The concept of 'wicked problems' has been used to guide research in many contexts, including public administration across boundaries (Kettl, 2006); administration and management of public health systems (Clarke & Stewart, 2000); managing sub-sections of health systems (Periyakoil, 2007); policy and design for addressing global issues (Durant & Legge, 2006; Margolin, 1996); critiquing 'whole of government' approaches to indigenous affairs (Humpage, 2005); addressing the issues of chemical weapons verification and biological terrorism (Hutchinson et al., 2002); strategic planning (Mason, 1969); risk management (Holt, 2004); processes for project definition (Whelton & Ballard, 2002) and boundary spanning research and design of IS and work practice systems for organisations (Gasson, 2005).

It has also been discussed as a concept to alert professionals to the fact that intractable problems will not be solved by a "cool logical and rational approach to problem solving" (Wagman, 2006: 5). Rosenhead and Mingers (2001) identify five approaches, including Soft Systems Methodology (SSM), which have been developed as subjectivist alternatives to traditional, objectivist modelling methods for understanding complexity in organisation situations and informing decisions involving change.

'Wicked' or 'ill-structured' as a way of conceptualising problems has been a foundation for IS research approaches responding to the limitations of 'hard' or linear systems approaches. For example, Checkland's Soft Systems Methodology (SSM) and Gasson's

framework for the co-design of business and IT systems (Checkland & Scholes, 1999; Gasson, 2008).

2.3.2 IS research approaches

IS research is concerned with generating insights for systems design so that the complex and dynamic relationship between the social, technical and cultural aspects of each work context are accounted for and supported responsively (Jacucci, Hanseth, & Lyytinen, 2006). The effects and management of technological change and the benefits of supporting and managing work activity in an organisation are also examined (Orlikowski & Hofman, 1997; Subrahmanian et al., 2003).

The IS discipline has developed a variety of methodologies, tools and techniques for understanding information needs of organisations as the basis for developing computer-based information systems that are intended to support organisation activities and goals (Avison & Fitzgerald, 1995).

Some IS approaches seek to structure and control the messy reality of real world situations. 'Design science' (Hevner, March, Park, & Ram, 2004; March & Smith, 1995) is a IS research stream that aims to build knowledge and improve the practice of IS design. However, it has been criticised for its focus and emphasis on technical software engineering and failing to embrace social and organisational considerations (Marshall & McKay, 2005).

For others, the conception of nature of the IS design problem has shifted from structured and bounded to ill-structured with ambiguous boundaries (Gregor & Jones, 2007); from a technical activity that is one component of the systems design "waterfall model" to encompass the range of activities from problem identification through to solution implementation and evaluation (Gasson, 2003).

The insight that the perspectives of users of information systems are important for good IS design is associated with a number of user-centred research and design approaches (Gasson, 2003). However, the context of IS design for organisations is constrained by factors (time, resources, budget) that reduce the effectiveness of user-centred approaches (Kujala, 2003). In addition, most IS approaches support a technology frame that prioritises technical system goals and problem definition at the expense of social system goals and human understandings of what is needed (Gasson, 2003).

One proposal to prevent too quickly bounding ill-structured problems to suit technical design requirements is to explicitly treat IS research and design contexts as wicked problem spaces (Checkland & Scholes, 1999; Gasson, 2003). Wicked problems require a process of inquiry for a problem situation rather than goal-directed solving a well-defined problem. This approach involves iteratively reconceptualising the problem situation and incremental partial design solutions with emergent properties (Checkland & Scholes, 1999; Gasson, 2003). Systems concepts are used to stimulate and structure debate about the nature of a problem to help structure thinking and learning about a complex real-world situation, rather than seeking to objectively model a situation as a system (Rosenhead & Mingers, 2001).

SSM (Section 2.4.2.) is a process-oriented approach developed out of the systems discipline (Checkland & Scholes, 1999) and considered one of many methodologies suitable for IS research (Avison & Fitzgerald, 1995). SSM integrates social and technical aspects of human activity with system-level understanding of interactions involving human activity over time and space (Checkland & Scholes, 1999; Walsham, 1993).

2.3.3 Socio-technical (qualitative) research approaches

Qualitative, socio-technical approaches are valued to support or evaluate IS/ICT system designs (Berg et al., 2003). Many socio-technical frameworks have a developmental understanding of human activity that incorporates historical, cultural and political elements into systems descriptions and have been proved suitable for IS-focused research (Engeström, 1999, 2000; Hutchins, 1995a; Wenger, 1998). IS researchers have co-opted qualitative approaches and techniques into their own frameworks to generate understanding of organisations and to inform the design of more human-centred information systems (Nemeth, 2006; Bate, 2002).

Many qualitative approaches are aligned with a constructionist grounded theory approach to research (Schwandt, 2003). Socio-technical research with a social constructionist and interactionist perspective uses qualitative approaches to highlight the mediating effects of technologies on human beings and society and aim to understand the implications and consequences of ICT on human activities (Berg, 1999; Berg et al., 2003). Not only computer-based technologies, but the standards embedded in their code are powerful in constructing certain ways of viewing and working in a situation (Bijker, Hughes, & Pinch, 1987; Bowker & Star, 2000; Star, 1991).

Grounded Theory Methodology (GTM) is a process of empirical inquiry used for socio-technical research that takes time and experience (Strauss & Corbin, 1994). A GTM approach assumes that data drives understanding a setting and systematic analysis is needed to uncover multiple perspectives in a setting. GTM does not generate a substantive theory of action from one research project; Strauss and Corbin advise utilising different theories as lenses for analysis to build models that can contribute to a substantive theory (1994).

A variety of analytic frameworks have been generated by versions of a grounded theoretical approach and are widely used in socio-technical research for understanding aspects of organisation information systems and work systems (Gasson, 2004a; Østerlund & Carlile, 2005). Theoretical frameworks can be utilised as lenses to focus attention on particular aspects of a setting for data generation. Elements in a setting can be viewed as static or dynamic and located on a trajectory of change; having substantive or relational attributes; as detached or situated in social and historical contexts (Gasson, 2004a; Østerlund & Carlile, 2005).

Writing on grounded theory in IS research, Gasson (2004b) notes the trend for multiple methodologies (able to deal with both context and process) in IS research. Such approaches can generate deep or multilayer theoretical models and support the IS researcher to reflect and question assumptions about the research problem and the extent to which the data analysis can be generalised. The underlying concepts and

methodologies of GTM, case study approach, and SSM have been declared compatible (Sutrisna & Barrett, 2007).

In addition, qualitative research has a number of established techniques to facilitate purposeful data generation including field observations, interviews, document collection, video recording and immersion of the researcher in the field (Mason, 2002).

Documenting a trajectory of interactions, for example, to follow a client or patient interacting with organisation systems and processes, is a technique that can generate insights into organisation activities and uncover problematic assumptions (Latour, 2004). Identifying multiple perspectives by trajectory data can deliver insights about a setting that has possible relevance for systems design (Wales, O'Neill, & Mirmalek, 2002). Rich pictures have been successfully used as a tool in health research to aid complex analysis within a Grounded Theory Methodology (GTM) framework (Sutrisna & Barrett, 2007).

2.3.4 Summary: Conceptual Background – Method

The literature on 'wicked problems' challenges the notion that any setting involving organised human activity will solely experience problems that are easily understood and resolved by a linear problem solving approach of problem definition followed by rational analysis leading to an optimum problem solution (Rosenhead & Mingers, 2001). On this basis, the BST setting was entered assuming it would exhibit 'wicked' properties (Rittel, 1984 [1972]).

The conceptual background for the method is process inquiry approaches for wicked problem settings. 'Wicked problems' cannot be understood by a single method for solving a bounded problem definition. Wicked problem domains suit a process inquiry approach that incorporates a flexible method that can adapt to emergent issues and problems and incorporate flexibility with regard to method, tools and techniques for data collection and analysis.

Two streams of process inquiry approaches for researching IS/ICT and health domains have been identified for studying complex social organisation situations ('wicked' properties) involving human activity and information support provisions for activities. SSM is used within the IS discipline, and GTM is used within socio-technical research and in IS research. In addition, the proposal by Strauss and Corbin (1994) that a variety of theoretical lenses can contribute to the generation of a grounded theory and explanatory models is noted.

2.4 Conceptual Background – Data and Analysis

This section presents the conceptual background for Chapter 4 – Data and Analysis. The terms information systems, social and technical systems are specified. Two process inquiry approaches: SSM and GTM are described. Three socio-technical frameworks aligned with GTM are reviewed in terms of their application to understanding the roles and impacts of information systems and technologies in organisations.

2.4.1 Information and Socio-technical Systems

INFORMATION SYSTEM

This research shares the perspective that information systems are constructed; they enable organised action by human beings for whom information is a resource; information is obtained by data manipulation *and* attributing meaning to data (Checkland & Scholes, 1999). ‘Information system’ is broadly understood as a cultural phenomenon whose function is to support people to take purposeful action in contrast to a machine-based view focusing on the data manipulation functions of computers.

The communication difficulty that arises from this perspective is that ‘system’ is not used with that meaning in conversation. Its everyday use reinforces an assumption that there are systems in the world that can be labelled (e.g. *health care system*) and an assumption that “the world can be taken to be a set of interacting systems, some of which do not work very well and can be engineered to work better” (Checkland & Scholes, 1999: A10).

For an SSM approach:

1. **‘information’** is “[d]ata with attributed meaning in context”;
2. **‘information system’** is a construct used to talk about “[o]rganized provision of information in organizations ... linkable in principle to action: to deciding to do things, doing them, observing and recording the results-and then if necessary modifying the deciding, doing and recording” (Checkland & Scholes, 1999: 54-55).

SOCIO-TECHNICAL SYSTEM

An organisation situation can be described conceptually in terms of components that align with a ‘social system’ or ‘technical system’ way of thinking, for example (Gasson, 2003). From an SSM perspective, an ‘information system’ has both social system and technical system components.

Social systems consist of sets of relationships between human beings and modes of organising interactions between them. In contrast, technical systems consist of reified skills or knowledge and mechanisms for constructing interactions that enable human activity and achieving social goals (Engeström, 1999; Hutchins, 1995a; Wenger, 1998). Social systems consist of interactions between individuals and groups are characterised by a tendency to be cooperative and interdependent. Components of a technical system can include standards and rules, policies and procedures controlling practice; information artefacts which are used in a system of work practices to record and manage data relating to the conduct of the practice or that embed culturally acquired knowledge and aid individual or group cognition (www.dictionaty.com; (Gasson, 2003)).

Social structures and processes have very different characteristics to technical structures and processes for enabling organised human activity (Bowker & Star, 2000; Checkland & Scholes, 1999). Social structures integrate at the level of membership relations, indicated by perspectives, skills and knowledge and cooperative use of reifications of practice (artefacts including policies, procedures, information-artefacts – digital and

paper form) (Wenger, 1998). Technical structures integrate at the level of information relations (indicated by data elements and relationships), processes (information flows) and system context (entities connected by information inputs and outputs) (Dennis & Haley Wixom, 2000).

Social systems and technical systems are mutually constitutive and are usually conceptually integrated as 'socio-technical systems' (Hartswood, Procter, & Rouncefield, 2003).

Socio-technical systems are mutually constitutive: implementing new systems [electronic medical record] not only changes work practice but also impacts back on the system itself (2003: 242).

The mechanisms for organising relationships within the social sphere include technical aspects; technical systems have agency in the social sphere, often beyond the effects intended in the design (Hartswood et al., 2003).

2.4.2 Soft Systems Methodology (SSM)

SSM is a process-oriented approach used in IS research (Checkland & Scholes, 1999). It builds on the concept of ill-structured or wicked problem types (Rosenhead & Mingers, 2001) to conceptualise real-world organisation problem situations from a systems perspective. Appreciating a problem situation is a pre-requisite for information system design that will support the logical set of related work activities that are necessary to achieve an organisation's objectives (Checkland & Scholes, 1999).

SSM aims to conceptualise or represent problem situations in terms that make explicit social, technical, cultural and political perspectives and dynamic influences on organised human activity. It can be used simply as an adaptation of systems theory to a practical methodology with specific steps to follow and techniques for analysis (Avison & Fitzgerald, 1995; Braithwaite, Hindle, Iedema, & Westbrook, 2002).

However, mature SSM (mode two) is used as a reflective 'inquiring process' guided by an ideal of 'constitutive rules' and employing the SSM epistemology to enable debate. The aim of mature SSM is to reach shared understanding of an organisation situation and define desirable and feasible changes for the work practice system and the information system supporting its activities (Checkland & Scholes, 1999).

SSM conceives two interrelated systems: systems for organising and controlling the way human actors work in an organisation and systems for managing information to support those work practices. It is systemic in two ways: "It is, as a whole, *a learning system*; it is one that happens to make use of *system models*" (Checkland & Scholes, 1999: 311). Thus, in SSM, 'systems' thinking is applied to the process of inquiry, not the object of inquiry (Checkland & Scholes, 1999).

The focus on process is a distinction which is also foundational in Rittel's (1984 [1972]; 1973) 'second generation' approach to 'wicked problems'. The scope of the concept 'design' in this discourse extends from problem conceptualisation through to evaluation of any design interventions (problem solutions) implemented (Checkland & Scholes, 1999).

SSM provides a framework of ideas, a process for structured thinking based on systems ideas and an epistemology for expressing the outcome of SSM-based work (Checkland & Scholes, 1999). SSM-based work does not necessarily follow the whole SSM process, however there are certain guidelines that need to be present, notably the purpose of articulating dialogue “aimed at defining changes deemed desirable and feasible” (Checkland & Scholes, 1999: 287).

SSM provides data analysis techniques that can be used to gain a rich appreciation of a wicked problem situation and conceptually model an organisation as an activity system supported by an information system (Avison & Fitzgerald, 1995), including rich pictures. Rich pictures provide a summary of everything known about the organisation situation (important people, activities and issues) (Avison & Fitzgerald, 1995).

Rich pictures are a particularly useful tool in SSM for gathering information about a complex situation:

Within SSM the ideas of representing the complexities of a human situation in picture form has been a powerful one. ... It is an efficacious way of recording the finding-out phase because relationships and interactions are more briskly captured in pictures than in linear prose. However, the fundamental requirement is to gain a discussable appreciation of a problem situation; pictorial representation is simply one means of doing that which has been found useful (Checkland & Scholes, 1999: 155).

A rich picture summarises a complicated situation by a combination of pictorial symbols and text that can be hand-drawn sketches or diagrams using computer software. SSM rich pictures are a useful, but not an essential, tool. The purpose of drawing rich pictures is to gain an abstract appreciation of a problem situation (Checkland & Scholes, 1999).

Rich pictures are used in the pre-analysis phase before any judgments have been made about the processes and structures operating in the situation. It is a tool that taps into the intuitive insights of the researcher into subjective aspects of a situation (e.g. points of view, human characteristics) and well as enabling relatively unstructured recording of objective observations such as physical layout, relationships and connections between people and things, causal influences and effects (Checkland & Scholes, 1999).

From an SSM perspective, a conceptual model is a systemic account of a human activity system based on a root definition of the system’s purpose and containing the logical activities required to achieve the activity’s purpose (Checkland, 1993). It shows how various activities are (or would better be) related to each other (Avison & Fitzgerald, 1995). The root definition makes explicit which perspective on the problem being addressed is considered relevant for describing the transformation desired.

SSM provides a conceptual framework for the research process that guides a researcher to appreciate the problem situation for an organisation setting, select a relevant perspective (significant problem theme) and conceptually model the situation from that perspective (iteratively, testing the model) (Kelder & Turner, 2008).

2.4.3 Grounded Theory Methodology (GTM)

GTM is often discussed in terms of a reflexive process to generate contribution to knowledge grounded in empirical data; a flexible approach learned through practice rather than a prescriptive method (Gasson, 2004b). GTM is a theory/concept-generating approach to research (Grbich, 1999). It is used to generate substantive theory out of particular instances of empirical research. Formal theory can only be proposed after sufficient time, reflection and cases to which the substantive theory is transferrable (Gasson, 2004b).

Although data driven and focused on the specific setting, the approach supports the utilisation of a range of theoretical lenses to sensitise the researcher to possibilities for data to collect and constructs for analysing the elements and relations in the data (Strauss & Corbin, 1994). Sensitising concepts are drawn from symbolic interactionism and also other frameworks (Strauss & Corbin, 1994). The endpoint of GTM is a “critical dialogue between the data, the emergent theoretical propositions and relevant theoretical/conceptual frameworks” (Grbich, 1999: 30). The iterative process of data collection, analysis and synthesis continues until theoretical saturation, “when theoretical constructs fit with existing data *and* the comparison of theoretical constructs with new data yields no significant new insights” (Gasson, 2004b: 86-87).

Different theories of analysis and constructs generated in other research settings can be applied to empirical data to provide insights that facilitate the process of abstracting a rich and detailed appreciation of a problem situation for an organisation into a model that can be discussed and debated. This also tests the transferability of lenses proposed as formal theories in additional substantive settings, increasing their claims for rigour as set out by Gasson (2004b).

Care is needed to balance the need for a researcher to have solid knowledge of the research area and possible theoretical or conceptual frameworks that may be relevant (to prevent replicating the researcher’s own biases) against the problem of over-direction by the literature (preventing the researcher seeing evolving issues in the setting) (Grbich, 1999).

GTM provides a set of flexible strategies for qualitative data analysis to identify concepts and develop an explanatory framework that specifies relationships between concepts. Strategies relate to data collection, coding, memo writing and theoretical sampling (Charmaz, 2000; Gasson, 2004b). The purpose of theoretical sampling is to refine ideas, identify conceptual boundaries and relevant categories and how they fit together (Charmaz, 2000). Grounded data is constantly compared to existing theoretical/conceptual concepts (Grbich, 1999).

Categories and themes in grounded theory research are developed from data by different strategies for different knowledge generation purposes. Categories are important for determining what is in the data and developed in the initial analytic phase. Categories are defined, described and related to other categories. A theme expresses the topic or essential meaning narrative that is present right through the data. A theme is developed at a later phase of analysis and contextualises the data; categories decontextualise the data and resulting definitions and models are more generalisable (Morse, 2008).

Table 8-1 summarises Gasson's principles for using a Grounded Theory approach in IS research and how they were applied in this research project.

2.4.4 Socio-technical Theoretical Frameworks

Qualitative frameworks for analysing and understanding research settings consist of ethnographic values, assumptions, theories and techniques to construct ways of representing the elements in a research setting and the interactions between them (Grbich, 1999). Theoretical frameworks from qualitative socio-technical research have been applied in IS research projects to understand the roles and impacts of technologies in organisations, particularly on the ways people perceive and do their work (Whitman & Woszczyński, 2003).

Different socio-technical approaches align at certain points, for example applying a cultural and historical approach (a strong element of Activity Theory) to distributed cognition (Cole & Engeström, 1993), the understanding that relations or interactions involving human actors and their artefacts in the local environment are important for understanding complex processes and situations in an organisation setting (Østerlund & Carlile, 2005) and attending to issues of "human agency embedded in the everyday actions and interactions of people doing work in various organizational positions and settings" (Engeström & Middleton, 1996: 1).

Theoretical frameworks for investigating the role and impacts of information systems on work in organisations each have associated challenges and benefits for achieving research objectives. Comparative evaluations between distinct frameworks, for example distributed cognition and activity theory, identify different challenges and benefits in utilising one or the other (Halverson, 2002). The literature also contains explorations of similarities and differences between frameworks: symbolic interactionism and activity theory (Star, 1996); activity theory, cognitive ergonomics and distributed cognition theory (Decortis, Noirfalise, & Saudelli, 2000); communities of practice and activity theory in the context of social organisation learning (Elkjaer, 2003).

Socially situated, practice theories have distinct advantages over dualistic, substantialist approaches (Østerlund & Carlile, 2005); they supply a rich source of theoretical concepts and frameworks (Gasson, 2004a). Practice theories assume reality is "vague, with blurred edge and in shades of gray" (and therefore category boundaries are also blurred). They build on process thinking and look for the emergent qualities of action, presume change and expect social conflict, and have a fluid notion of practice (Østerlund & Carlile, 2005). This understanding aligns with the concept of 'wicked' problems (Rittel, 1984 [1972]).

Research that takes a specifically distributed view of work in organisations focuses on the cognitive processes of human actors in coordination with each other and the technological artefacts in their work environment (Boland, Tenkasi, & Te'eni, 1994; Greenburg & Dickelman, 2000). Gasson (2004a) indicates the suitability of adopting a framework of distributed cognition and/or one of socially situated cognition involving individuals, groups and the technological system in IS research projects.

Distributed Cognition theory (Hutchins, 1995a) is a theoretical framework that is useful to guide data collection and provide a theory for analysis of a setting involving

organised human activities. The theory focuses analysis on the cognitive role of mediating artefacts and people-artefact cognitive interactions developing over time as a cultural phenomenon (Hutchins, 1995a). It is used to analyse the role of tools (artefacts) in computation (Hutchins, 1995a, 1995b), the organisation of team performance (Hutchins, 1995a), communication paths and patterns in socially distributed cognitive activity (Hutchins, 1995a, 1995b, 2000) and processes of individual and organisational learning and cultural change (Hutchins, 1995a).

The theory has been subsequently applied in a range of eclectic studies at the Distributed Cognition and Human-Computer Interaction Laboratory at the University of California San Diego (<http://hci.ucsd.edu/>), led by Professors Jim Hollan and Ed Hutchins. Recent examples include using the theory to study mobile information needs (Sohn, Li, Griswold, & Hollan, 2008), design digital artefacts to support medical conversations between deaf and hearing individuals (Piper & Hollan, 2008) and studying 'gestures' as cognitive artefacts in the context of developing scientific theories (Becvar, Hollan, & Hutchins, 2008).

Distributed Cognition theory has been identified as a useful framework for research focussing on computer-supported cooperative work (Rogers & Ellis, 1994) and Human Computer Interaction (HCI) (Halverson, 1994; Hollan, Hutchins, & Kirsh, 2000) and more generally in the design of information technology to support work in organisations (Boland et al., 1994). Gasson (2004a) has noted that different perspectives or frames operating in an organisation can be analysed from a distributed cognition perspective for congruence and differences in work or knowledge coordination across domains; intersections and union of interactions in collaborative work or how technology mediated group knowledge is constructed and used.

Wenger (1998) emphasises the concept of identity that is over time and space and multi-communal, although Østerlund and Carlile (2005) note that Wenger does not provide much empirical support for his theoretical framework at the level of multi-communities. Dimensions of change is specified in terms of an individual's position in several communities and modes of belonging through engagement and alignment with communities' practices (Østerlund & Carlile, 2005). Østerlund and Carlile (2005) also critique the broader literature that has adopted practice theory constructs for losing the relational essence of practice theory and failing to investigate the power relations, potential conflicts and contradicting interests that are co-present with evidence of positive alignment and engagement.

Communities of Practice theory (Wenger, 1998) is aligned with other practice theories (including distributed cognition and activity theory). It provides an extended source of theoretical constructs for understanding what people do and how they do it without artificial distinctions between agents and artefacts, culture and organisation: for seeing social groups in a setting as an integral whole of people in a set of dynamic relations with their tools and in their local environment (Østerlund & Carlile, 2005).

Communities of Practice theory is a social theory of learning, and as such, has not been widely used in Information Systems research. IS-related research examples include learning in virtual worlds (Oliver & Carr, 2009), a member interface approach to a mobile virtual community of practice (Kawash, 2009) and design implications for an augmented reality teaching aid (Anastassova & Burkhardt, 2009).

Activity Theory (Engeström, 1999) is a theoretical lens that is often discussed in conjunction with distributed cognition and practice theories (Østerlund & Carlile, 2005). It takes human activity as the unit of analysis/focus. Its conceptual model for understanding the research setting focuses on activity as a series of culturally, technically and socially mediated interactions.

Activity Theory, in common with anti-idealist, anti-individualist, anti-rationalist sociological theories, seeks to explicitly account for historical, cultural and temporal realities and the dialectal nature of workplace environments and their development (Star, 1996). It is proposed as a coherent conceptual framework that is more useful than using hybrid concepts like 'learning organization', 'knowledge management' and 'social capital' which operate as "stimulating but eclectic meeting points between different theoretical approaches and methodologies" (Engeström, 2000: 960).

To undertake activity theoretical research (which is inherently developmental and expansive in its object) requires the commitment of the organisation to engage in a resource intensive program of work analysis and redesign (for example resourcing staff participation in a "boundary crossing laboratory" (Engeström, 2001)), which is not always feasible. However Activity Theory is useful as a way of conceptualising work (Kuutti, 1995; Kuutti & Arvonen, 1992).

An Activity theoretical approach properly has the expectation of participant activity and goal of structural change (Engeström, 2001). Inherent in Activity Theory is *cycles of expansive learning* – which requires vertical and horizontal processes of learning and development, confronting management viewpoints with everyday reality in the form of feedback (Engeström, 2001).

The *Centre for Activity Theory and Developmental Work Research* at the University of Helsinki (<http://www.edu.helsinki.fi/activity/>) undertakes a range of research in work, technology and organisations going through transformations. Recent examples of research from the Centre include investigating learning and network collaboration in product development (Miettinen, Lehenkari, & Tuunainen, 2008) and developing a collaborative care agreement tool and a new practice of negotiated care for patients with chronic illness (Kerosuo, 2006).

In Information Systems research, Activity Theory has been applied, among others, to studying computer-supported activities (Diaper & Lindgaard, 2008; Kaptelinin & Nardi, 1997) and information seeking behaviour (Wilson, 2006), software requirements elicitation (Martins & Daltrini, 1999) and information systems development and design (Boutet, 2008; Matthews, Rattenbury, & Carter, 2007; Uden, 2007; Uden & Helo, 2008).

2.4.5 Summary: Conceptual Background – Data and Analysis

The conceptual background informing the data and analysis of this research comes from a diverse range of approaches to human-centred socio-technical research. SSM is sensitive to issues from a perspective of an information support system; GTM is sensitive to issues from a perspective of social consequences of socio-technical interactions.

Two GTM principles in particular are adopted for this research: grounding analysis in data from the setting and using a range of philosophically aligned theoretical frameworks as lenses and sources of constructs for conceptual modelling a problem domain. In particular, three complementary theories have been described that are grounded in qualitative data and used in a variety of research activities explain aspects of organised (purposeful) human activity. These theories are: Distributed Cognition theory (Hutchins, 1995a), Communities of Practice theory (Wenger, 1998) and Activity Theory (Engeström, 1999).

Information systems research has utilised Distributed Cognition theory and Activity Theory in a range of contexts and for a variety of purposes; Communities of Practice theory has not been applied extensively in Information Systems research, but is frequently applied in research seeking to understand what people do and how they do it without artificial distinctions between agents and artefacts, culture and organisation, particularly in knowledge sharing (Østerlund & Carlile, 2005).

In Section 2.5 these theories are described as sensitising lenses (Table 2-2) and synthesised according to a construct “people, place and thing” (PPT) (Table 2-3). The resulting PPT framework (Table 2-4) is used methodologically to guide the application of the three theories.

SSM provides a conceptual framework for the research process to guide a multi-method approach over three broadly conceived phases: 1) appreciate the problem situation → 2) select a relevant perspective (significant problem theme) → 3) conceptually model the situation from that perspective (and test the model). The use of theoretical frameworks from socio-technical grounded theory research can be guided by SSM in several ways. Broadly, in Phase one, the theories can be used to provide potential constructs and perspectives for data collected in Phase one. Phase two, they can be used as lenses to explore and generate insight into potential problem themes for the organisation. In Phase three, they can be drawn on to develop a substantive grounded theory and conceptual model for the research setting.

2.5 Conceptual Background – Constructs for Analysis

Theoretical frameworks from literature presenting qualitative socio-technical research approaches can be analysed for similarities and distinctive properties and synthesised into a heuristic device. Three theoretical frameworks in particular – Distributed Cognition, Communities of Practice and Activity Theory have been synthesised for use in this research as ‘people, place and thing’ (PPT) (Kelder, 2007; Kelder & Turner, 2005b, 2008).

The three frameworks used in this research were partly selected for pragmatic reasons, including the researcher was already familiar with Distributed Cognition theory (Kelder & Turner, 2005b) and aware of the other two theories. The three approaches shared a human-centred perspective and generic attributes that aligned with a concern to focus on interactions between ‘people, place and things’ and yet each provided a different focus to generate distinct insights.

This section presents the PPT-construct as a heuristic device. It also presents constructs drawn from socio-technical literature and used to structure the data for the conceptual

models that are the end-point of the analysis method. Constructs adopted as elements of the conceptual models are called 'PPT constructs' to indicate they are concepts aligned with the PPT-construct (heuristic device).

2.5.1 PPT-construct – heuristic device

DEVELOPMENT OF THE CONSTRUCT

Kelder and Turner first used the vocabulary of 'people, place and things' in (2005b) in their discussion of "the utility of Dcog theory in sensitizing designers to the cognitive implications of changes to information systems and/or work processes and ... how the use of Dcog can empower user centered design methodologies" (p. 79), aiming for a 'human-centred' approach in the sense of (Gasson, 2003). During the course of this research, the researcher reoriented and extended the conceptualisation of 'PPT.'

PPT as a construct was initially reoriented to guide identifying socio-technical frameworks and approaches that aligned with human-centred perspectives and demonstrated capacity to investigate and understand rich complex social domains (Kelder & Turner, 2005c) and 'wicked' problem situations. PPT-frameworks were selected on the grounds of: "capacity to accommodate and deliver insight into the interactions and relations between the people, the place and the things (PPT) in the setting" (Kelder, 2007), noting that many socio-technical frameworks had been fruitfully used in medical/health informatics research projects (Bate & Robert, 2002; Nemeth, O'Connor, Klock, & Cook, 2006).

Generic attributes for these PPT-frameworks/ approaches were identified: 1) qualitative techniques to capture a rich data set; 2) constructs to represent spatio-temporal interactions of people, place and things; 3) analysis for cultural and historical contextualisation of data; 4) techniques for challenging assumptions and generating new insights by redrawing the boundaries of what is under observation or changing the unit of analysis and 5) constructs and theory for insights into structural relations in a setting with implications for design of technical information systems (Kelder & Turner, 2008).

These attributes were built into and applied to the concept of PPT such that different PPT frameworks could be used as sensitising lenses to keep the research method open and a process of inquiry. Distributed Cognition theory (Hutchins, 1995a), Community of Practice theory (Wenger, 1998) and Activity Theory (Engeström, 1999) together provide useful sensitising concepts and lenses for data collection and analysis in a socio-technical setting, differently focusing on cognition, community and activity (see Table 2-2).

Theoretical framework used as a sensitising lens	Attend to ...
Distributed Cognition (Hutchins, 1995a)	Cognition: cognition stretched over mediating artefacts and people-artefact interactions; development of both practice and practitioners over time
Communities of Practice (Wenger, 1998)	Community: mechanisms for sharing and distributing knowledge and information (membership, brokers, boundary objects)
Activity theory (Engeström, 1999)	Activity: interactions mediated by tools, rules and division of labour for an activity

Table 2-2 PPT-theoretical frameworks sensitising lenses

The unit of analysis employed by different socio-technical theoretical frameworks varies. It can range from connected organisation groups (Bowker & Star, 2000; Brown & Duguid, 2000; Gasson, 2006), human activity systems (Engeström, 2000), functional systems of cognitive activity and artefacts used in cognitive activity (Hutchins, 1995a), connected people groups (Brown & Duguid, 2000; Wenger, 1998), individual users interacting with an information technology artefact (Johnson, Johnson, & Zhang, 2005) and trajectories of an organisation's clients interacting with the staff and information artefacts (Wales et al., 2002).

Wicked problem contexts are best studied as a process of inquiry, without a presumptive problem definition, perspective or boundary (Rittel & Weber, 1973). Kelder and Turner (Kelder, 2007; Kelder & Turner, 2005a, 2005b, 2005c, 2008) have explored and identified that it is useful to initially frame an organisation setting in terms of a flexible understanding of a setting as:

PPT: configurations of people, place and things (PPT) on trajectories of interaction over time

Table 2-3 synthesises a range of people, place and thing elements and PPT-configurations and different units of analysis that can be observed in a setting.

PEOPLE	Individuals as actors (organisation staff members, clients, workers external to the organisation), social groupings (teams, alliances, networks, communities of practice), social system.
PLACE	Physical environment, digital environment, geographical locations, work place physical layout.
THING	Physical and cognitive artefacts, information technologies, reified practice, tools, rules (policies, procedures, protocols, standards, etc), technical system.
PPT configurations	Trajectory of PPT interactions involving an individual client with: individual staff member, clinic team or the organisation via client information system. Trajectory of PPT interactions involving a single client record, aggregated client record data (reports).
Units of analysis for PPT – configurations	Individual-level, Team-level, Organisation-level, Enterprise-level, community of practice, functional units of distributed cognition, human activity system, 'technological frame' (Bijker, 1987). Boundaries are identifiable by social, political, technical, cultural distinctions as well as physical or geographical barriers.

Table 2-3 People, Place, Thing, PPT- configurations and units of analysis

PPT is similar to the OAT-construct (interacting elements: 'organisation', 'agents' and 'technology') referred to by Checkland in his discussion of sense-making in IS (Checkland & Holwell, 1998). Checkland placed the OAT-construct and OAT-relationships in a sense-making framework: "COAT." The "C, for conceptualising" (p. 232) was a reminder that OAT was part of a *conceptual* model for thinking about an organisation and its information systems.

In this sense, PPT-construct is useful as a heuristic device for connecting approaches which perceive the real world as comprised of mutually constituted social and technical systems of interaction between people, their environment, history and technologies (Bijker et al., 1987; Bijker & Law, 1992). As such, it is aligned with actor network theory concepts of trajectory and interactions between networks of human and artefact actors (Latour, 2005).

The PPT-construct is a tool to operationalise the GTM principle of using a range of theories of analysis (Strauss & Corbin, 1994). It is useful to identify frameworks that provide suitable lenses and constructs for analysing and structuring data from a setting. It may also indicate alternative units of analysis and additional data sources (Kelder, 2007; Kelder & Turner, 2008).

The PPT-construct heuristic device can be used in conjunction with Table 2-2 and Table 2-3 to generate options for data collection and analysis and facilitate the research method as an open process of inquiry sensitive to emergence.

2.5.2 PPT-Constructs – conceptual model elements

DISTRIBUTED COGNITION

The main constructs from Distributed Cognition used to organise and articulate observations and insights are *cognition as computation* and *cognition as a cultural process* such that cognitive activities are viewed as computations that take place by the propagation of *representational state* across *representational media* (Hutchins, 1995a). The key analytic tool for understanding cognitive processes is *mediating artefacts* that enable the propagation of states. The unit of analysis is the socio-technical-cultural system, with movable boundaries, dependent on the functional relationships between the elements (actors and artefacts) participating in cognitive processes (Hollan et al., 2000).

COMMUNITIES OF PRACTICE

The focus of Communities of Practice theoretical framework is learning and knowing and the *social production of meaning* is the relevant level of analysis for practice. Meaning has different levels in Wenger's theory, such that a single artefact can have different meaning for different groups who use it. The theory directs attention to the existence of mechanisms for sharing and distributing knowledge and information (people-brokers, artefacts-boundary objects) and applying Communities of Practice as a theoretical framework to a data set enables identifying non-institutional social configurations (Wenger, 1998).

Practice occurs in a historical and social context that gives structure and meaning to what people do. *Communities of practice* are the context in which people belong as members mutually engaged in productively working out their knowledge. "Therefore, the concept of practice highlights the social and negotiated character of both the explicit and the tacit in our lives" (Wenger, 1998: 47).

In the Communities of Practice framework, 'identity' is a property of the domain of interest connecting individual members of a community of practice. Identities are a complex of an individual's position in a practice and the position of the community of practice and of the individual in the broader socially structured environment. Identity includes a relationship to practice that includes participation and non-participation, belonging, identification and the ability to negotiate your role and place (Wenger, 1998).

The Community of Practice framework is a social theory of learning emphasising personal trajectories of change in practice and its focus is on the individual (Wenger, 1998). Brown and Duguid (2000) have the same theoretical practice-based perspective as Wenger, but shift the focus from the individual relations to the relational forces of sharing knowledge within communities of practice and knowledge sharing across communities of practice (Østerlund & Carlile, 2005). Knowledge emerges out of collective effort around shared practice in a community unit of analysis. The notion of *networks of practice* is a broader level of analysis to include shared practices that are common to professions or occupational networks, creating ecologies of knowledge (Brown & Duguid, 2000; Østerlund & Carlile, 2005). *Occupational community* (Araujo 1998) is an equivalent concept to network of practice.

Two constructs from Community of Practice theory are boundary objects and brokering:

boundary objects – artifacts, documents, terms, concepts, and other forms of reification around which communities of practice can organize their interconnections

brokering – connections provided by people who can introduce elements of one practice into another (Wenger, 1998: 105).

Brokering is a participative connection between communities of practice; it is uncomfortable because of the tension inherent in *multi-membership*. Brokers make new connections across communities of practice, enable coordination and can open new possibilities for meaning. Brokering uses the status of multi-membership to transfer elements of practice from one community into another. The process of brokering involves translation, coordination and alignment between perspectives; legitimacy to influence the development of the practice, mobilise attention and address conflicting interests. It also includes the ability to link practices by facilitating transactions between them and cause learning by introducing into a practice elements of another (Wenger, 1998). Brokering is closely aligned to the construct *institutional broker* in (Kelder, 2007; Kelder & Turner, 2008).

An object is a *boundary object* when and to the degree that it belongs to multiple practices with different perspectives and enables them to coordinate (Star & Griesemer, 1989; Wenger, 1998). The characteristics that enable an artefact to function as a boundary object are: modularity, abstraction, accommodation and standardisation (Wenger, 1998).

Boundary practice is a construct that is aligned with the *boundary maintenance* construct derived from the BST data set described in (Kelder, 2007; Kelder & Turner, 2008). Wenger defines boundary practice as an enterprise to “deal with boundaries and sustain a connection between a number of other practices by addressing conflicts, reconciling perspectives and finding resolutions” (Wenger, 1998: 114). Brokers and their boundary practices transform into a community of practice when the practices cease to create connections between communities of practice (and brokers become a community of practice in their own right) (Wenger, 1998).

Processes embedded in communities of practice (negotiation of meaning, learning, the development of practices and formation of identities and social configurations) involve complex interactions between the global and the local; communities of practice cannot engage with the global, only develop new ways of participating with the global (Wenger, 1998).

Reification of practice describes artefacts that enable coordination, cooperation and communication between members of a community of practice (Wenger, 1998). Artefacts can be analysed for their use at a local level (community of practice), global level (the community of context and the artefact use as a boundary object) and as global artefacts that have been naturalised into local use (Halverson, 2003). An associated concept is *naturalisation* of artefacts into a community of practice so that they become accepted and skilfully used tools of practice (Bowker & Star, 2000).

ACTIVITY THEORY

In Activity Theory, “An activity is a form of doing directed to an *object* and activities are distinguished from each other according to their objects” (Kuutti, 1995). Activity theory engenders thinking about interactions or relationships within an activity as culturally and historically mediated (Engeström, 1999).

Tools mediate the relationship between the *subject* and the *object* of an activity and incorporate the historical development of the relationship. Both subject and object are related to a *community* that shares the object of the activity. *Rules* mediate the relations between the community and subject and *division of labour* mediates the relationship between the community and the object of the activity (Kuutti, 1995).

Kuutti has used the structure of Activity Theory to classify types of work support in a CSCW context (Kuutti & Arvonen, 1992). Kuutti classified the range of relationships between an actor in a work situation and the support system for their work according to the role of the person towards the support system: pre-determined, active or expansive (see Kuutti, 1995 Figure 3: 236). This classification was used for identifying the types of support for work in an organisation; the roles people have towards artefacts supporting an activity and the potential for active or expansive learning.

Activity Theory concepts and model can be used to investigate particular actions and the scripts (expectations for actions) from multiple perspectives (different subjects with different objectives). It can be used to identify rules, instruments/tools, communities, subject, object and division of labour for short-term goal-directed activities and systems of activities. It has been used to identify historical cultural activity systems that cohere around a central motivation of patient health service provision (Engeström, 2000).

Disturbances, contradictions (sometimes indicated by breakdowns in coordination) indicate developmentally significant systemic contradictions and change potentials with the activity; internal contradictions between object and motive of activity; “troubles” caused by lack of coordination and communication Contradictions enable identification of root causes of problem – “crucial precondition for creation of a shared vision for the expansive solution of the contradictions” (Engeström, 2000: 966).

2.5.3 Additional Constructs

TECHNOLOGICAL FRAME

‘Technological frame’ is an interactional concept (Bijker, 1987) applying to interactions of actors. Technological frames structure the attribution of meaning attributed to an artefact by members of a social group:

A technological frame is composed of ... the concepts and techniques employed by a community in its problem solving ... Problem solving [is] a broad concept, encompassing within it the recognition of what counts as a problem as well as the strategies available for solving the problems and the requirements a solution has to meet. ... This makes a technological frame into a combination of current theories, tacit knowledge, engineering practice (such as design methods and criteria), specialized testing procedures, goals, and handling and using practice (Bijker, 1987: 168). It includes “such different elements as current theories, goals, problem-solving strategies, and practices of use” (171).

Technological frame is a construct used to facilitate understanding the process of individual and group sense-making in particular social situations. Perspectives, values, roles, culture and assumptions are framed in and by configurations of interacting in any setting and several 'technological frames' may be operational in any boundary spanning context (Gasson, 2006).

Technological frame analysis involves analysis of social network utilisation, linking organisational roles and group membership with specific technological frames (Gasson, 2008). Specific frames can be related to group membership. Social membership can be an important indicator for changes in actor roles and conflicts between actor perspectives according to whether "in-network" actors are pushing a specific frame-of-reference when the "out-of-network" actors hold a different perspective. Individual alignment with group membership is an important factor in an individual's attitude to a technology and can help understanding and explanation of why technology applications in an organisation have evolved in the way that they did and how individuals' roles have co-evolved alongside a technology development (Gasson, 2006, 2008).

Frame analysis has been proposed as a strategy for organisational research in contrast to approaches that look at issues through multiple lenses or frames (Creed, Langstraat, & Scully, 2002). In the latter, researchers apply multiple lenses and metaphors to represent different ways of viewing the same thing whereas frame analysis focuses on identifying and analysing the actors' lenses and metaphors to represent their viewpoints (Creed et al., 2002). *Technological frame* is thus a construct for identifying conflicting perspectives on the purpose of a technology or technical system.

TRAJECTORY CONSTRUCT

The concept of trajectory originated in actor network theory and has been appropriated as a general and useful construct for generating new perspectives on data, with only peripheral association with the theory itself (Gasson, 2006). Actor-network theories "describe long-term practices in the enrolment and mobilization of actors around specific problems, goals and actions" (Østerlund & Carlile, 2005: 95). In actor-network theory, trajectories of action are analysed by embedded or translated interests at the boundaries or junctions between person-person, group-group or people-artefact.

The concept of trajectory can be extended to consider the cultural-historical trajectory of an organisation, artefact or career. Trajectory analysis can be undertaken for a particular person or artefact and to analyse interactions for each activity that person or artefact is involved in. For example, client trajectories provided a different context for thinking about organisation systems design by focussing on the activity and the client, not the system (Wales et al., 2002). Similarly, Latour's analysis of a patient trajectory in a hospital provided a vehicle for a critique of normative science and a persuasive argument for a different way of conceptualising a patient's body (Latour, 2004).

BOUNDARY AND RELATED CONSTRUCTS

The use of the concept *boundary* has a rich history of use in socio-technical research and been incorporated in many theoretical frameworks. The construct has been extended to include boundary object, boundary infrastructure, boundary work (articulation and coordination) (Bowker & Star, 2000).

Boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual use. The objects may be abstract or concrete. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation. The creation and management of boundary objects is a key process in developing and maintaining coherence across intersecting social worlds (Star & Griesemer, 1989: 393).

The construct is most useful in analysing cooperative and relatively equal situations of information interactions (Bowker & Star, 2000). Objects that have been naturalised into multiple practices cease to function as boundary objects; they operate as standards within and across the work contexts in which they are naturalised (Bowker & Star, 2000). This situation requires a working information infrastructure that serves multiple communities of practice simultaneously and independently regardless of location or allegiance. A *boundary infrastructure* is the shared infrastructure between diverse communities of practice that supports the range of information objects used in conducting their work (Bowker & Star, 2000).

Four types of ‘boundary object’ were first articulated in (Star & Griesemer, 1989): repositories, ideal types, coincident boundaries and standardised forms. Candidate boundary object types for the context of a health service organisation are: ‘ideal type’ (e.g. process diagram representing routine clinical pathway) and ‘standardized forms’ (e.g. standardised discharge letter (Winthereik & Vikkelsø, 2005)).

Boundary-object analysis is a technique for analysing distributed cognition in a setting. It is based on the notion that each person only has access to part of the “big picture” of what is known in total. Different sets of knowledge are mediated by boundary objects that allow people to share different types of knowledge for specific purposes, in different ways (Star & Griesemer, 1989).

2.5.4 Summary: Conceptual Background – Constructs

The PPT-construct is a heuristic device synthesised from socio-technical frameworks: Distributed Cognition theory, Communities of Practice theory and Activity Theory. The frameworks philosophically align with human-centred research and focus on trajectories of interactions between people, place and thing (PPT). PPT is useful for identifying and using analytic frameworks as lenses to indicate potential perspectives or constructs for structuring data and also to stimulate additional lines of data collection and analysis.

A range of PPT constructs were articulated in Section 2.5.2 and Section 2.5.3. Table 2-4 summarises the constructs provided by PPT-theoretical frameworks used as analytic lenses for structuring the data and additional constructs derived from socio-technical research literature. The bolded constructs were incorporated in Model one (Figure 1-1).

PPT-theoretical framework	PPT-RELATIONS and CONSTRUCTS
DISTRIBUTED COGNITION (Hutchins, 1995a)	<ul style="list-style-type: none"> • Cognition as cultural (cognitive artefact; boundary object) • Artefacts as culturally constituted and mediating cognition • Work practice systems as distributed cognition and context for learning • Moment of practice, development of the practice, development of the practitioner
COMMUNITIES OF PRACTICE (Wenger, 1998)	<ul style="list-style-type: none"> • Knowledge production in communities of practice • Member, Multi-membership • Boundary Objects • Brokers • Constellation of practice • Trajectory into membership • Reified practice; naturalisation of artefacts into practice
ACTIVITY THEORY (Engeström, 1999)	<ul style="list-style-type: none"> • Activity/ action/ operation distinction and relations • Subject/object mediation by rules, instruments, division of labour, community • Multiple perspectives • Breakdowns, disturbances, contradictions • Trajectories of activities (developmental process, naturalisation)
(Brown & Duguid, 2000); (Bowker & Star, 2000)	ADDITIONAL CONSTRUCTS:
	<ul style="list-style-type: none"> • 'network of practice' • People-artefact trajectories • Boundary infrastructure • Naturalisation

Table 2-4 PPT-theoretical frameworks and PPT-constructs

2.6 Summary – Literature Review

This chapter has provided the key aspects of the literature that inform the method and findings of the thesis. The contextual background of the research is a health service delivery setting with the properties of a wicked problem domain in which the role of IS/ICT is caught up in tensions between competing aspects of models for quality care and mechanisms for sustainable health care delivery.

The conceptual background for the research approach is human-centred approaches in Information Systems and socio-technical research suitable for wicked problem settings. Human-centred approaches to IS research have increasingly adopted more complex methods for investigating these sorts of wicked problem domains in order to better understand, analyse and develop IS to suit the information requirements to support health care service delivery into the future.

The conceptual underpinnings of the research thus align with an understanding that health service delivery into the future does not *have* a fundamental problem that can be solved by better IS design, but *is* a wicked problem that sits between competing and opposing forces and expectations.

A heuristic device (PPT-construct) is synthesised for use within a process inquiry framework that is guided by SSM, draws on GTM principles and utilises both SSM and

GTM tools and techniques for data collection and analysis. Specific PPT-constructs incorporated into the conceptual models developed in phase three of the method are also presented as conceptual background to the analysis.

The following chapter presents the method developed for approaching the BST setting, in response to the methodological issue:

What is a suitable approach to scientifically investigate, understand, analyse and develop information support systems for wicked problem domains like BST?

The characteristics of the research approach were derived from the literature. SSM (Checkland & Scholes, 1999) provided the conceptual framework for the research method, developed as a process of inquiry over three phases that build on each other. Principles for data collection and analysis were derived from GTM. GTM supports trialling a range of theoretical frameworks as sensitising lenses for applying different theories of analysis to the data.

The research approach is to utilise multiple methods for data collection and data analysis and 'PPT-construct' as a heuristic device. The PPT-construct was synthesised from socio-technical literature to keep the research open to different sources of data; units of analysis; analytic lenses and techniques for structuring data from the setting. The endpoint of the method is appreciation of a problem situation for an organisation expressed as a problem theme and conceptual models that can be used to analyse the problem from the perspective of the role and impact of IS/ICT and thinking of alternative designs for information systems to support the organisation activities.

CHAPTER THREE – METHOD

CHAPTER 3 METHOD

This chapter sets out the method that was used to investigate the role and impact of IS/ICT in a health service organisation delivering breast screening and assessment services to women in Tasmania, BST. The research aimed to scientifically investigate, understand and analyse the information support system for BST, leading to conceptual models to facilitate thinking about alternative information systems that would better support the organisation activities.

‘Wicked’ problem properties can characterise any organised human activity, including health service delivery (see Section 2.3.1). This method approaches IS research in a health service delivery setting as a process of inquiry into a domain in which problems are likely to be ill-structured and problem solutions have unexpected emergent effects (Rosenhead & Mingers, 2001). It builds in techniques to keep the researcher open to data and analysis that leads to an appreciation of a problem situation, instead of seeking a bounded problem definition (Checkland & Scholes, 1999).

CHAPTER THREE OUTLINE

Section 3.1 introduces the research approach for the BST setting: method, units of analysis and data sources, and the critical reflection questions activity in each phase of the method are. Table 3-1 provides the structure for the research method as a process of inquiry.

Section 3.1 sets out phase one of the method. The focus is familiarisation and sense-making, leading to appreciation of a relevant problem situation for BST.

Section 3.3 describes phase two of the method which is focused on analysis to identify a significant structural property of the research setting that problematically affects PPT-interactions, expressed as a problem theme.

Section 3.4 phase three of the research involves first conceptualising the chosen theme, then constructing and testing conceptual models using the *nexus between accreditation and practice* (the research theme identified in phase two) as a lens.

Section 3.5 sets out the method for interpreting and discussing the analysis outcomes of the research process.

3.1 Introduction

The research approach is a multi-method process of inquiry (drawing on SSM and GTM) that is structured into three phases:

1. familiarisation and sense-making to appreciate the problem situation;
2. identifying and selecting a problem theme;
3. developing conceptual models that represent the BST situation (expressed by the theme).

The method uses the PPT-construct in conjunction with PPT-frameworks (see Table 2-4) as a heuristic device to keep the research process open as a process of inquiry.

PPT construct: configurations of people, place and things (PPT) on trajectories of interaction over time

Table 3-1 is the method guiding the research process and provides the structure for a systematic investigation in BST as a wicked problem domain. Each phase has a particular focus and involves a set of activities and an iterative cycle of data collection and analysis. A phase is concluded by critical reflection on the products of the analysis leading to a specific outcome (e.g. problem situation appreciation in phase one).

Table 3-1 is supplemented by Table 3-2 and Table 3-3. Table 3-2 sets out units of analysis and data sources. Table 3-3 gives more detail on the '*critically reflecting*' activity for each phase. The purpose of critical reflection is to determine what is significant for the next phase in understanding, representing and discussing the BST situation with a view to developing better information support systems for the organisation.

Research Question: What is the role of the information system in the functioning of a breast screening and assessment service in Tasmania and what is its impact?		
Method		Results
Research Process	Techniques	Analysis Outcomes
Phase One: <i>familiarisation and sense-making</i> Activities <ul style="list-style-type: none"> • <i>generating</i> a data set; • <i>documenting</i> PPT trajectories; • <i>describing</i> activities; • <i>drawing</i> rich pictures • <i>critically reflecting</i> on key elements, relationships and perspectives. 	Data Collection Field data; PPT-trajectory. Data Analysis Trajectory mapping; Rich picture construction Focus questions	Structured Data Products Problem situation appreciation (table 4-1) leading to → phase two
Phase Two: <i>identifying a problem theme</i> Activities <ul style="list-style-type: none"> • <i>identifying</i> problem stories; • <i>mapping</i> PPT constructs; • <i>critically reflecting</i> on the problems; • <i>selecting</i> a key problem theme for further investigation. 	Data Collection Field data; Semi-structured interviews. Data Analysis PPT constructs map onto rich pictures; Focus questions; Assess evidence for problem theme selection;	Structured Data Products Problem theme identification (table 4-1) leading to → phase three
Phase Three: <i>conceptualising a theme</i> Activities <ul style="list-style-type: none"> • <i>researching</i> key terms; • <i>conceptual modelling</i>; • <i>testing</i> conceptual models • <i>critically reflecting</i> in relation to model development 	Data Collection Validation/ disconfirmation field data (organisation documents, email questions); Data Analysis Qualitative modelling (constructs and relationships); IS modelling (data, process views); Focus questions	Structured Data Products Theme conceptualisation (table 4-1) leading to → Interpretation and Discussion (table 4-1 and table 5-1)

Table 3-1 Three phase, human centred, multi-method approach for wicked problem situations

The PPT-construct was used to sensitise the researcher to data collection opportunities or gaps in data for a unit of analysis. Data was collected from a range of sources and was not confined to the institutional boundary of the organisation. This produced a rich data set covering multiple domains and perspectives both within the BST setting and its wider context (see Table 3-2).

UNIT OF ANALYSIS	POTENTIAL DATA SOURCE
individual	Interviews (unstructured, semi-structured, structured), observation, participant observation (as client, videoed), trajectory of client PPT-interactions with staff and organisation IS, client record
team/group	Semi-structured interviews, field observations, participant observation (as staff member)
organisation	Organisation documents (minutes, reports, memos, manuals), client information system technical documents, client record reports, interviews
enterprise (for networked organisations)	Publicly available documents (Internet); organisation reports, organisation documents, observation of enterprise-related activities, interviews (semi-structured, some structured)
PPT-trajectories for single activity or set of activities	Field observations (organisation service activities, organisation support activities); Trajectories of PPT-interactions (focus on person, place or thing interacting with other PPT over time)

Table 3-2 Units of Analysis and Potential Data Sources

Critical reflection questions were developed during the research, and used in each phase to guide data collection and guide the analysis towards generating insights based on an appreciation of multiple perspectives (Table 3-3). Critical reflection questions were book-ended by the research questions. The table illustrates the relationship between the research questions and critical reflection questions.

Critical reflection questions had two different orientations and were used as a technique to guide the researcher first to be open to possibilities for data collection and analysis for each phase and then to focus on interpreting the significance of the analysis outcomes of each phase for the next. Questions with an exploratory focus were developed by drawing on PPT-theoretical frameworks identified in the literature review, addressing issues and drawing attention to different units of analysis. Questions with an interpretation focus were a technique to guide synthesising insights from analysing the data using PPT-frameworks, guided by the analysis outcome for each phase: problem appreciation → problem theme identification → theme conceptualisation.

Research Question: What is the role of the information system in the functioning of a breast screening and assessment service in Tasmania and what is its impact?		
Research Process	Exploratory Focus – PPT-construct	Interpretation Focus – Theme Identification → Conceptual Model Development
Phase One: <i>familiarisation and sense-making</i> Critically reflecting on key elements, relationships and perspectives	<ul style="list-style-type: none"> What people, place and things (PPT) in the organisation are involved in interactions with clients? What problems occur during client interactions with the organisation? 	<ul style="list-style-type: none"> What is problematic in the organisation IS and/or work processes if the organisation is to support client decision-making and meet expectations? What PPT relationships and perspectives are evident between work place, digital and other artefacts and ways people perceive and do their work? What influences do these relationships and perspectives have in the problem situations observed in BST?
Phase Two: <i>identifying a problem theme</i> Critically reflecting on the problems	<ul style="list-style-type: none"> What are possible themes that express a problem situation for the organisation? What are possible analytic lenses and constructs that can be used to describe and understand the theme? 	Which theme(s) has structural and/or 'wicked' elements that are linked to significant problems or a problem situation for the organisation?
Phase Three: <i>conceptualising a theme</i> Critically reflecting in relation to model development	<ul style="list-style-type: none"> What PPT-elements and activity sets of interactions are included in the problem theme [nexus between accreditation and practice]? What constructs are available in the literature and what constructs grounded in the data can be used to describe the situation? 	<ul style="list-style-type: none"> What is the relationship between the conduct of the [breast screening] enterprise and the requirement to measure and report on the quality of the [screening] work done? What are the differences between measuring the work done by an organisation and measuring the work done by an individual? What are the influences and effects of the nexus in the research setting?
Research Questions – using conceptual models What is the role and impact of the client record on accrediting breast screening and assessment services in Tasmania and supporting decisions of individual clinicians and individual patients/clients? How does the information system (organised information support) impact on the roles and interactions amongst professionals (recruitment, administration, management, data and clinical) working in BST?		

Table 3-3 Research critical reflection questions

3.2 Phase One – familiarisation and sense-making

From Table 3-1

Research Process	Techniques	Analysis Outcomes
Phase One: familiarisation and sense-making Activities <ul style="list-style-type: none"> • <i>generating</i> a data set; • <i>documenting</i> PPT trajectories; • <i>describing</i> activities; • <i>drawing</i> rich pictures • <i>critically reflecting</i> on key elements, relationships and perspectives. 	Data Collection Field data; PPT-trajectory. Data Analysis Trajectory mapping; Rich picture construction Focus questions	Structured Data Products <ol style="list-style-type: none"> 1. Rich pictures 2. Work Flows and Data flows 3. Systems views of BST (social, technical): organisation and client perspectives Problem situation appreciation → phase two Key elements; relationships

Familiarisation and sense-making was facilitated by extended exposure to the organisation to accumulate the range of observations, conversations, unstructured interviews, opportunities to participate in activities and experience what it is like to work in that context and to explore and record the range of experiences and perspectives of clients. An extended period of time in the field also allowed the researcher to observe and understand the evolution of the organisation: to hear stories from participants of its history and aspirations for its future; record decisions and activities seeking to respond to pressures constraining the ability of the organisation to conduct its enterprise successfully and their relative success or failure.

3.2.1 Generating a rich data set

DATA COLLECTION PROCESS – PHASE ONE

Phase one data was collected in the period from mid-March to end of May 2005 over sixteen extended observations (2-3 ‘full-day’ field visits per week). The organisation setting provided a rich and varied supply of potentially useful data for different units of analysis (Table 3-2). Data collection and analysis was iterative and interactive, prompted by the PPT-constructs.

Exploratory focus (See Table 3-3)

What PPTs in the organisation are involved in interactions with clients?
 What problems occur during client interactions with the organisation?

Specifically:

- Who are the actors (types of clients, staff member roles, organisations)?
- What are the artefacts? (cognitive artefacts, reified practice, tools)
- Which actors use which artefacts when?
- What mechanisms are used to distribute information or physical things? (boundary objects, brokers, members, negotiated practice, rules, division of labour)
- What are the timescales? (minutes, days, weeks)

- What are the recurring conversations/ contested topics?
- Where do workflows break down?
- Where does information support (data flows) breakdown?

The researcher particularly paid attention to data that indicated problems from a client's perspective. The focus question below was designed to uncover and challenge assumptions about clients' information needs that are embedded in an organisation design (information system and work practice design) (Wales et al., 2002).

Theme Identification focus (see Table 3-3)

What is problematic in the organisation IS and/or work processes if BST is to support client decision-making and meet expectations?

Field notes included data on PPT interactions, issues and activities; opportunistic unstructured interviews (conversations) with participants; researcher memos and critical reflections on possible connections and interrelationships. Field notes were typed up at the conclusion of each field visit and stored in electronic folders, cross referenced to a *Research Record* document (see Table 8-2 and Table 8-3). The researcher also collected organisation documents for analysis. The documents related to everyday work practices and activities involving other organisations, including mandated or scheduled activities and ad hoc interactions.

Field observations ranged from short to extended timeframes, depending on what was the focus of attention. Examples of an extended observation included spending a whole day in one place that was part of the wider setting or tracing a trajectory of events or activities that develops over weeks, months or the life of the project. The observation data was supplemented by organisation documents that set out the policies and procedures for observed activities. Observations over short timeframes targeted specific activities and repeated observations were made (client trajectories) to establish data patterns and exceptions to routine/expected processes.

Participant observation as a client provided the researcher with a subjective, illustrative experience of what it can be like for a client to interact with the health service organisation. The video-record of the researcher-as-client provided detailed observation field data of a client experience that supplemented field notes from client trajectory observations. Participant observation as staff-member was primarily during staff meetings but also included organising and facilitation roles. For example, the researcher was expected to give opinions and information to support decision-making as well as requested to help organise and then facilitate a staff training day. These situations were an opportunity to subjectively experience the problems observed in the organisation and to document data that related to the researcher's interpretation of the problems as a problem situation. This data informed critical reflection on the differences between the researcher's response to recurring conversations, contested topics, conflicting expectations and issues and the responses of staff members to problems.

DATA ANALYSIS PROCESS

In phase one, data was collected and analysed drawing on a technique of using different theoretical lenses to sensitise the researcher to different people, place and things (PPT)

and their inter-relationships. The field notes and organisation documents were analysed iteratively.

The first pass analysis was to list documents as they were created in a MS Excel spreadsheet. This *Research Record* (Table 8-2 and Table 8-3) was a record of all artefacts of the research data collection and analysis process with summary comments, memos to the researcher.

The second pass was to take the different PPT-analytic lenses and apply them to data from documents selected on the basis of the *Research Record* comments. The purpose was not to model the organisation from one particular perspective, but to leverage different PPT-analytic insights on perspectives, elements and relationships in organisation settings to identify a problem theme that is grounded in the organisation situation data. The focus questions were:

Theme Identification focus (see Table 3-3)

What relationships and perspectives are evident between work place (P), digital and other artefacts (T), and ways people (P) perceive and do their work?
What influences do these relationships and perspectives have in the problem situations observed in BST?

Preliminary diagrams and models of the organisation situation were constructed from the perspective of the different PPT-analytic frameworks (Distributed Cognition, Communities of Practice and Activity Theory) by a process of reviewing data record documents, coding data using constructs from the theoretical frameworks and noting in reflective memos where data indicated something different was happening. Instances where PPT-constructs mapped to data and where they did not were incorporated into rich pictures.

The third pass over the data in this phase was to construct a series of short documents synthesising different aspects of organisation situation in the form of partial, preliminary findings, also cross-referenced in the *Research Record*. An important part in this process was to present and discuss preliminary findings within the IS academic community in conference and workshop settings (Kelder, 2005; Kelder & Turner, 2005a, 2005b, 2005c) or in personal communication with academic colleagues.

3.2.2 Documenting Trajectories

Trajectories of PPT-interactions were documented as a technique to:

- *situate* the researcher in the domain;
- *generate* a stream of data about organisation work practice and information system design from the perspective of different actors' needs and assumptions, particularly clients;
- *identify* other significant trajectories of PPT interactions in the organisation (e.g. the client record trajectory);
- *identify* organisation-level assumptions about the nature and location of boundaries and client expectations and needs.

Trajectories observed by the researcher are listed in Table 3-4 below:

PPT - TRAJECTORIES	DATA COLLECTION
'Client' trajectory	
Finding out about the Program; leaving the Program (discharge)	Organisation policy and procedure documents; client letters; interview comments
Registering with the Program	Client-staff member interactions mediated by telephone and Client Information System
Clinical pathways for clients: routine breast x-ray (mammogram) → recall for further assessment → results	14 clients in 'routine screening' clinic; 7 clients in 'recall for assessment' clinic; 1 client in 'results' clinic
Client interactions outside organisation boundaries (recruitment; discharged from Program)	Participant observation with recruitment and education staff member; staff meetings and organisation documents (policies);
'Client Record' trajectory	
Client record pathway within the research setting (creation, cycle of use, store, archive)	Observations of client record use and transport between locations where used
'Organisation' trajectory	
BST interactions with other organisations BST organisation history BreastScreening Program (BSA) history	Organisation documents (reports to government agencies; reports to BSA) and staff meeting field notes <i>BreastScreen Sustainability into the Future Project: Business Case</i> (BreastScreen Tasmania Business Case, 2003) National Accreditation Standards manual

Table 3-4 PPT-trajectories documented by the researcher

For ethical and logistical reasons, it was not possible to follow a specific client through a trajectory of interactions with BST from booking an appointment through to receiving a results letter.

Fourteen client trajectories for a routine screen in the Hobart clinic were documented over four half-day field visits. Seven client trajectories through an assessment clinic occupied two full-day field visits and included one results clinic for a client receiving a definitive cancer diagnosis. For client record trajectories outside the clinic context, the researcher made two half-day observations of data staff taking phone calls from clients to register for the Program and/or book an appointment and took part in three activities as a participant observer with the Community Education and Recruitment officer. 'Organisation' trajectories were constructed from public and BST documents recounting the history of the national Program BSA and the specific history of BST; explanatory comments from interviews and observations of two SAC meetings. The historical data sources provided cultural and contextual information to support the analysis of the current organisation situation.

PPT-trajectory documentation focused on clients recorded speech interactions; body gestures; physical layout of the place in which interactions occur; physical movement through the place; things (artefacts) used as part of interactions. Taking field notes was

physically arduous and mentally tiring; the pace of interactions is such that field notes tend to be cryptic and miss interactions. It was important for the researcher to find a quiet place and type up the records of interactions immediately after an observation period, especially following a sequence of repeated trajectories. The handwritten field notes acted as both record and memory aid to create a more detailed and structured set of field notes in an Excel spreadsheet.

The interactions were summarised as a process description for the sets of client-interactions, noting exceptions and variations to the normal pattern for different clients (Table 8-4 is a sample). The field data of different sequences of client interactions with the organisation was compared to the organisation work flow chart depicting interaction processes designed for clients. The field notes description included extra activities not formally specified by the organisation flow chart, but observed by the researcher of staff members interactions with clients.

Trajectories data was used to trace and analyse the causes and effects of work activity system breakdowns beyond the immediate location of problem symptoms. A flexible unit of analysis was adopted for the client record trajectory depending on the relevant PPT elements for each stage of a client record trajectory. The purpose was to work out data that is important for understanding the organisation situation and possibly useful in later phases of the research), note where questions arose in what was observed and plan the next steps in the field.

The data set was analysed using critical reflection on the nature of the data, the assumptions of the researcher, the data that might have been expected but not observed. Example questions were:

- Why did client 1 do ...?
- Why haven't I seen any clients who are first-timers?
- Client P seems a good example of a routine client trajectory (use for later write-ups?)
- What PPT-interactions occur (that are relevant to the client experience of the organisation) when they are not personally participating?

Sufficient trajectories were observed when no new patterns of interactions were observed or when no new problem situations related to PPT-interactions were identified.

A complementary data collection technique was to video trajectories of interactions. Videoing is more intrusive and ethically difficult in socially sensitive settings such as health service delivery. A compromise was to supplement field notes with a single participant-observation video accompanied by reflective memos. This technique had much lower ethical clearance issues. It provided the researcher with experiential knowledge of a sequence of PPT-interactions within an organisation (for example, as client) and provided the researcher with a visual record from an 'outsider' perspective that was intimately connected to the 'insider' perspective expressed in the memos.

The structured client data, supplemented by the notes of the researcher's subjective participant observation, were analysed for perspectives about why and how clients engage with the organisation service and for experiences where expectations differed

from organisation-level assumptions about client information and health service needs (Wales et al., 2002). This was the basis of descriptions of client experience (or perspectives or challenging behaviours) and informed rich picture construction (Section 3.2.3 and 3.2.4). It also provided data on different boundaries and perspectives operating within an organisation as well as specific boundary crossing activities associated with problems in the organisation.

Trajectories data provided a baseline from which to establish interactions with the organisation's clients that occurred routinely. Field data and organisation documents provided examples and evidence of variations in client/staff experience and perspectives from expected or routine. Routine trajectories of PPT-interactions (no problems) indicated how an organisation's work system and information system was designed to work; deviations from the routine provided data indicating how such systems worked in everyday practice (including breakdowns and workarounds).

3.2.3 Drawing Rich Pictures

The process of generating the data set, particularly the trajectories data, generated a deep appreciation (Checkland & Scholes, 1999) of the organisation situation in the researcher. The client trajectories, observations of PPT-interactions, documents and interviews provided a broad range of data across multiple domains and units of analysis.

Over 100 rich pictures were drawn throughout phase one drawing on the full range of data collected. Rich pictures were drawn in Visual Art diaries, dated and numbered. This provided a visual and text record of the evolution of the researcher's knowledge and understanding of the BST situation: the elements, relationships and perspectives attached to PPT-trajectories of client interactions with BST-people and BST-artefacts.

The combination of pictures and text incorporated perspectives that challenged the organisation view of its information system and/or systems of work practice and highlighted PPT-interactions linked to recurring "problem stories" in the organisation. Rich pictures indicated conflicts, breakdowns and barriers to effective functioning and additional PPT data was collected to inform a more focused analysis (Section 4.3).

The range of data and analysis documents in the *Research Record* (Table 8-3) were analysed for contested or recurring conversation topics and different stakeholder descriptions of problem situations (see Table 8-5). Perspectives and stories that linked together were the evidence for themes that could then be traced across the data set at multiple levels and were usually present in stories involving problems with the work practice systems and information system that supports staff members in their work activities.

Initial rich pictures were full of information gaps and functioned to prompt further data collection. Later iterations of data collection and analysis enabled more developed rich pictures that focused on particular people, places or things, for example elements, relationships and perspectives connected to data flows involving the client record (paper and electronic).

Rich picture drawing concluded with a summary rich picture (Figure 4-3) and accompanying description setting out the researcher's appreciation of the BST situation,

particularly wicked problem properties of competing perspectives and opposing forces causing tensions. This rich picture was used as an anchor for describing the activities in the domain (Section 3.2.4) in terms of workflows and data flows as well as social and technical systems for organisation-client interactions. It aided the researcher switching the level of analysis between local details and the wider context of the organisation activity system and to identify loops of interactions that feed backward or forward to affect other parts of the work activity systems and information systems operating in the research setting.

3.2.4 Describing Activities

The trajectories data (example, Table 8-4), supplemented by the data set in the *Research Record*, was used to construct descriptions of workflows and data-flows involving actors, artefacts and interaction mechanisms for the trajectories of BST clients. These process descriptions were then modelled as a human activity system supported by an information system (Figure 4-6).

The researcher used the PPT-construct to select units of analysis (Table 3-2) to analyse the set of (work and data flow) process descriptions in conjunction with the field observations and trajectories data in order to identify the organisation's view of clients and client challenges to the organisation view (see Table 4-3). The organisation view was analysed from an information system perspective and a social system perspective. Client perspectives were indicated by behaviours that challenge the organisation system views. Rich pictures provided an anchor for changing levels of analysis from individual to organisation-level.

Organisation View of Clients: Social System view

- How are clients categorised from a work practice (social system) perspective?
- What are the similarities and differences?
- How do categories change for different points on an individual client trajectory?
- What changes occur in the properties of interactions for different points on a client trajectory?

Organisation View of Clients: Information System view

- What are the interaction mechanisms for this part of the system?
- What are the issues evident at this part of the system?
- Why did [something observed] occur?
- Why has [something I expected] not occurred?

Client Challenges to the organisation view

- Which client attributes in the client trajectory data do not fit the organisation perspective?
- Which client practices and (implied) expectations conflict with the organisation system of work?
- Where do client attributes conflict with requirements of the organisation IS and work practice system?

An IS process model of data/information flows in the research setting was drawn at organisation context level (Dennis & Haley Wixom, 2000) (see Figure 4-7). The IS analysis was done at a high level in this phase, because a business process analysis project started two weeks before the research project and the outputs of that project were to be made available on completion within three months. Staff members were already being interviewed by the business analyst from a data and work flow perspective; the research project therefore focused on the sociological rather than technical information gathering.

3.2.5 Transition to phase two

In phase one, PPT frameworks were used as the basis for structuring the results of the initial ethnography in order to gain an understanding of the domain and the relationship between elements in the domain.

The researcher reflected on the structured data products from the phase one analysis and discussed its meaning with colleagues and BST participants. The summary rich picture (Figure 4-3) was developed and then described to express the researcher's subjective appreciation of the problem situation in the BST setting. The workflow and data flow analysis was interpreted using the PPT-construct to identify constructs and relationships from Activity Theory and Communities of Practice theory that fit the data. SSM and systems concepts from the IS discipline were used to interpret BST as a system of work activity supported by an information system. The analysis of BST as a social system and as a technical system was interpreted using PPT-constructs and relations.

3.3 Phase two – identifying a problem theme

From Table 3-1:

Research Process	Techniques	Analysis Outcomes
Phase Two: <i>identifying a problem theme</i> Activities <ul style="list-style-type: none"> • <i>identifying</i> problem stories; • <i>mapping</i> PPT constructs; • <i>critically reflecting</i> on the problems; • <i>selecting</i> a key problem theme for further investigation. 	Data Collection Field data; Semi-structured interviews. Data Analysis PPT constructs map onto rich pictures; Focus questions; Assess evidence for problem theme selection.	Structured Data Products <ol style="list-style-type: none"> 1. Constructs and relationships (grounded in data; adopted from PPT-theoretical frameworks) 2. Theme: nexus between accreditation and practice. Problem theme identification → phase three Problem theme

As the fieldwork progressed, mapping the data to the PPT-frameworks started to reveal inconsistencies that needed to be explored further which led to the identification of an organisation-wide problem theme and the need to develop new conceptual models for analysing the setting.

The problem theme for BST identified in phase two was a *nexus between accreditation and practice*.

DATA COLLECTION PROCESS – PHASE TWO

Phase two of the research at BST was approximately from June 2005 to October 2005. The researcher reduced regular data collection to one day/week in the field and additionally observed or participated in “non-routine” organisation activities such as the site accreditation visit (full week), gap analysis for the Client Information System tender (two days) and the staff planning day. The rich picture indicated it was important to focus on the relationship between data-oriented BST work and client-service oriented work (education and recruitment, clinical health service).

Phase two data collection included eleven semi-structured interviews and a range of organisation documents (electronic and paper). Interviews were conducted for 60 to 90 minutes and designed to explore in depth a participant’s role and their perspective on their (changing) role in the organisation.

The researcher regularly reviewed phase one and phase two field notes listed in the *Research Record* and analysed them in conjunction with interview data as reflective memos or analytic notes. These analytic documents were entered onto the *Research Record*, cross-referenced with field notes documents. To understand the activity of staff members whose work focused on the data aspects of the client record, the researcher selectively reviewed field notes listed in the *Research Record* for insight into the work required of data-oriented staff members and the rationale for that work. The researcher also collected organisation documents to gather more detailed understanding of the relationship between data-oriented BST work and client-service oriented work.

3.3.1 Identifying stories: problem situation descriptions

The activity descriptions and rich pictures developed in phase one were analysed to identify what was problematic in the setting and what recurring stories and ideas have emerged from the phase one analysis. The focus was data that was interesting from an IS perspective – indicating situations in which the technical information system failed to support the human activity system from either an individual, group or organisation level.

The analysis of rich pictures and activity descriptions focused on evidence of disjunctions/breakdowns between the systems of human activity (work practices) and the information system supporting the work of staff members. The analysis also incorporated data of any networks of interactions that extended beyond the organisation boundaries that fed data or information back to the organisation and influenced organisation work practices.

Problem stories indicated by the rich pictures and activity descriptions were incorporated into PPT-theoretical frameworks by iteratively trialling the frameworks and constructs to understand the processes and structures operating in the BST situation and their relationship to the problems (see Figure 4-8). Problem story data that did not fit a PPT-framework or that indicated the value of a different unit of analysis were analysed for a common theme that could be used as a new analytic perspective for describing and modelling the organisation in terms of the key properties of the BST problem situation. Problem stories for BST were identified and grouped as data artefact and data practice stories; clinical practice stories and accreditation stories. Problem

stories from a client perspective were grouped as expectations not met and challenging behaviours (See Table 8-6).

Problem stories were expressed as organisation challenges that had the properties of a wicked problem, apparently intractable to finding a solution (see Table 8-7):

- How to identify and meet client expectations for the breast screening service when those expectations contradict or challenge the premises underlying an accreditation standard?
- How to maintain BST's accreditation status as provider of a high quality breast screening service in the face of internal constraints and constraints from its external context?

3.3.2 Mapping PPT constructs

The PPT-construct was used to guide the use made of various theories of analysis (PPT-theoretical frameworks, Table 2-4). These different theories were each mapped to the rich pictures developed in phase one (see Figure 4-8) to leverage the explanatory power of PPT-frameworks data analysis and build a structural understanding of the organisation situation that included contextual and cultural insights. This mapping process provided insights about the properties of problems in the research setting and identified structures and processes, particularly at the boundaries and intersections of BST activities. This included identifying different social worlds, interactions across boundaries and the roles of boundary-crossing people and things.

Distributed Cognition, Communities of Practice and Activity Theory were the primary PPT-frameworks deployed in this analysis for understanding of the domain and the relationship between elements in the BST setting. Additional constructs from the literature were trialled in the data analysis as candidate concepts for articulating the elements and relationships observed and documented in the field notes, interview transcripts and organisation documents.

Additional constructs from socio-technical literature were also mapped to the rich pictures. Brown and Duguid's (2000) *network of practice* was useful to explain differences across relationships between clinicians. Bowker and Star's (2000) construct *boundary infrastructure* was trialled and adopted as its definition was consistent with data and provided insight on the role of certain artefacts (Table 4-4). The rich pictures were also analysed for evidence of social structures and infrastructures (Bowker & Star, 2000) underlying and supporting work practices and activities in BST.

Other constructs were trialled that did not map to the rich pictures. McEchern's (1934) definition for *system of practice* did not 'fit'¹⁷ the data relationships evident within BST.

¹⁷ The concept of data "fit" is used here and elsewhere in the sense that the elements and relationships observed and documented in the field notes, interview transcripts and organisation documents can be mapped to constructs and relationships already articulated in PPT-frameworks and vice versa. Candidate PPT-constructs or relationships are tested for inconsistency with the meaning and relationships evident in the data. When constructs are conceptually adequate to express the researcher's

3.3.3 Critical Reflection

The researcher used critical reflection as a technique throughout the research, particularly in phase two to guide selection of a key problem theme for further investigation. Critical reflection questions were constructed in response to the emergent data used to facilitate developing an appreciation of the problem situation. This appreciation was multi-perspective and multi-domain and distinguishing between judgments about matters of fact and expressions of value (Checkland & Scholes, 1999).

The focus of critical reflection from the perspective of phase two was to identify concepts and relationships emerging from the outcomes of the sense-making techniques for phase one, and explore ‘wicked’ aspects of the BST situation that could be expressed as a problem theme for the organisation. Mapping the data to the PPT framework was a technique that revealed inconsistencies that needed to be explored further which led to the identification of the problem theme and the need to develop new analytical models. Critical reflection was used to identify perspectives and work practices represented in the rich pictures and activity descriptions that mapped to PPT-constructs and PPT-frameworks available from the literature.

Data analysis evolved from being guided by exploratory questions focusing on values, meanings and significance of what was observed to questions directing the researcher to judgments on matters of fact – what is really the case – to inform the construction of a conceptual model.

PPT-constructs were incorporated into a set of critical reflection questions of the data to guide the exploratory focus for phase two (Table 3-3).

Exploratory focus (see Table 3-3)

What are possible themes that express a problem situation for the organisation?

What are possible analytic lenses and constructs that can be used to describe and understand the theme?

Questions were developed to explore the data fit with PPT-constructs from the PPT-theoretical frameworks (Engeström, 1999; Hutchins, 1995a; Wenger, 1998). The data set was field notes and analysis documents from the *Research Record*, supplemented by documents from the accrediting organisation (BSA) and BST documents.

The questions focused on the client record as a *mediating artefact* (Hutchins, 1995a); client service and the data oriented staff members issues as *membership* and *multi-membership* properties (Wenger, 1998). The researcher drew on Activity Theory (Engeström, 1999) perspective to develop questions to guide data collection and analysis on the mediating roles and impacts of artefacts (tools), rules, community and division of labour in human activity systems. These questions teased out differences in

understanding of a grouping of data from the BST setting it is not necessary to articulate a new construct or relationship.

perspectives between groups of work practices (human activity systems) in different areas in BST.

Questions were developed that focused the investigation on different perspectives regarding the purpose of BST artefacts for the different activities identified (organisation-level accreditation, individual-level accreditation and for supporting screening and assessment clinical practice. Additional questions focused on the boundaries between social worlds distinguished by different work activities and uses of BST artefacts, particularly the client record that was an artefact used by most of the different teams within BST and prompted critical reflection on the effects of different boundaries. For the list of questions, see Table 8-8.

The data analysis mapping PPT-theoretical frameworks to rich pictures had provided different possibilities for structuring the problem domain and different constructs for describing PPT-elements and relationships in the data. The analysis using critical reflection questions derived from PPT-theoretical frameworks provided a more detailed analysis focused on testing the fit of the PPT-constructs with different units of data. In phase two, the researcher grouped aspects of the problem situation (specific problems and perspectives) according to different PPT-theoretical perspectives, identifying particular PPT-constructs and relations that provided insight for understanding or describing the problems (Table 4-4).

3.3.4 Problem Theme: nexus between accreditation and practice

The researcher reflected on the data from phase two to identify a relevant problem theme for the organisation that indicated ‘wicked’ properties, affecting BST activities at structural level. The data was drawn from field notes, trajectories data, organisation documents and interview data.

Theme Identification (Table 3-3)

Which theme(s) has structural and/or ‘wicked’ elements that are linked to significant problems or a problem situation for the organisation?

The data was analysed to identify the primary focus of actors in the setting, and the artefacts they interacted with or used to support different actors’ work (Table 4-5). Questions from Table 8-8 were used to identify and clarify the relationships between actors’ roles, the artefacts they used and opposing or competing perspectives. Table 8-9 is an example of data on conflicting perspectives and relationships between staff members on the issue of radiographer work practices and meeting standards.

The theme *a nexus between accreditation and practice* was selected on the basis that it was evident in the range of data as: 1) a recurring or implicit idea that connected to an appreciation of a wicked problem situation for the organisation and 2) potentially reflected underlying assumptions affecting organisation design of structures and processes.

The researcher used the *Research Record* to review the data and establish connections between the field notes, trajectories and interview data in order to assess the strength of

evidence the *nexus between accreditation and practice* could be utilised as a lens for understanding problematic PPT-interactions traversing the organisation. The researcher also investigated whether the *nexus* could be applied to understand interactions beyond the organisation boundaries to include interactions with external entities (e.g. clients, BSA, government entities).

3.3.5 Transition to phase three

Phase two data analysis was interpreted at two levels: 1) identifying PPT constructs and relationships that could reasonably be applied to structure the data (for varying units of analysis/ focus) and 2) selecting the problem theme.

The selection of a theme (in this case *a nexus between accreditation and practice*) as a problem theme for BST was a subjective choice by the researcher based on evidence from the analysis that it provided a connecting thread for data: a recurrent or implicit idea, connecting problem stories within the setting at multiple levels of analysis and across the organisation activities. In addition to reviewing structured data from phases one and two, Table 8-10 was constructed to provide an overview of the PPT-frameworks and constructs linked to field data collected. The primary value of the table was the process of constructing it: focusing the researcher on the evidence base for analytic decisions.

This theme was not evident by applying a particular PPT theoretical perspective, but emerged from the inquiry process designed to develop a rich appreciation of a wicked problem situation for the organisation and express it as a theme. Once the theme was identified, the PPT-constructs that had been used in structuring the data and contributed insights into the BST problem situation were interpreted as potentially useful in phase three to describe PPT-elements and relationships that were connected to the *nexus*. These and other constructs were candidate constructs in the process of developing conceptual models.

3.4 Phase three – conceptualising a problem theme

From Table 3-1:

Research Process	Techniques	Analysis Outcomes
Phase Three: <i>conceptualising a theme</i> Activities <ul style="list-style-type: none"> • <i>researching</i> key terms; • <i>conceptual modelling</i>; • <i>testing</i> conceptual models • <i>critically reflecting</i> in relation to model development 	Data Collection Validation/ disconfirmation field data (organisation documents, email questions); Data Analysis Qualitative modelling (constructs and relationships); IS modelling (data, process views); Focus questions	Structured Data Products <ol style="list-style-type: none"> 1. Theme description; Boundary maintenance and Institutional broker constructs 2. Model one: nexus between accreditation and practice 3. Test → DFD and E-R diagrams for IS 4. Model two: information orientations for an integrated client record; Boundary maintenance construct Interpretation and Discussion Table 4-1 and Table 5-1

The method for phase three is to research the problem theme and use it as a lens to develop a conceptual model of the BST situation to enable the researcher to answer the research questions.

3.4.1 Researching the theme

The following focus was adopted to facilitate the transition of the analysis from focusing on theme identification to conceptual model development. It also provided a guide further data collection and analysis:

Exploratory focus (Table 3-3)

What PPT-elements and activity sets of interactions are included in the problem theme [nexus between accreditation and practice]?

What constructs are available in the literature and what constructs grounded in the data can be used to describe the situation?

The process included an iterative series of analyses that fed into the conceptual modelling activity:

- Develop a classification scheme for ‘accreditation’ and ‘practice’ that reveal different perspectives in the setting related to the *nexus*;
- Identify and articulate constructs for describing the *nexus* (some PPT-constructs were already mapped to the domain in phase two);
- Identify activities and roles which did not fit the constructs already mapped to the domain;
- Articulate new constructs for such an activity (*boundary maintenance*, *institutional broker*).

The researcher reviewed the data sets generated in phases one and two. The focus was on identifying assumptions and implicit perspectives controlling the meaning and significance of the terms *accreditation* and of *practice* when used in the BST context. The researcher also investigated the different meanings of ‘accreditation’ in the literature (Section 2.2.3). This multi-domain analysis formed the basis for defining the meanings of accreditation and practice for different perspectives in the setting.

The researcher used the construct ‘technological frames’ (Bijker et al., 1987) to analyse the different frames operating in BST for different actors’ perspectives on the purpose of accreditation, noting variations in perspectives associated with role in the organisation and the unit of analysis (Table 3-2). An organisation-level analysis of perspectives on accreditation gave a different construction of accreditation to an individual-level frame (Table 4-6).

3.4.2 Conceptual Modelling

The conceptual modelling exercise used the key data elements and structural relationships in the BST situation identified in phases one and two and the outcomes of an exploratory focus on the *nexus between accreditation and practice*. The modelling focus was on the following:

Conceptual Modelling focus (see Table 3-3)

What is the relationship between the conduct of the [breast screening] enterprise and the requirement to measure and report on the quality of the [screening] work done?

What are the differences between measuring the work done by an organisation and measuring the work done by an individual?

What are the influences and effects of the nexus in the research setting?

The key terms for the problem theme (accreditation and practice) were distinguished by meanings of the terms for different units of analysis (e.g. individual practice; community practice; organisation practice; accreditation of individual; accreditation of profession and accreditation of organisation). This formed the basis for deciding the elements and relationships for the conceptual models.

The researcher iterated constructing prose descriptions of relationships between the constructs identified and diagramming models. Sociological literature was reviewed for additional conceptualisations of PPT interactions and useful constructs to inform this activity. *Boundary infrastructure* and *naturalisation of artefacts into practice* (Bowker & Star, 2000) were introduced to explain the canonical status of the NAS within the BSA Program of Service organisations.

The iterative analysis generated two conceptual models (Figure 1-1 and Figure 1-2) to facilitate describing, explaining and discussing the role and impact of the IS in the functioning of delivering and accrediting breast screening and assessment services in Tasmania. Model Two was developed following the process outlined in Section 3.4.3.

3.4.3 Testing the conceptual models

The two conceptual models were checked for validity across the spectrum of BST roles by specific (verbal and email) questioning of participants (Program Manager, Data Manager, Assistant Data Manager, Project Officer, Community Education and Recruitment Officer, radiographer, radiologist). The researcher also analysed BST documents (for e.g. BreastScreen Tasmania Business Case, 2003) and found that introductory comments or background remarks expressed perspectives in alignment with the rationale articulated in the NAS manual (National Quality Management Review Committee, 2002) for an accredited breast screening Program.

SOCIAL SYSTEM ANALYSIS

Model one was developed using sociological techniques and methods, focusing on BST as a social system supported by a technical system, including information support. The researcher tested the constructs and model of their relationships with targeted ethnographical observations, including email questions. Role-specific elements of the models were discussed with individual participants across the range of roles in BST for agreement of fit with everyday real-world experience.

In particular, Model one was shown to the participants engaged in *boundary maintenance* for comment. The Program Manager disliked the term but, with some

qualifications and caveats, agreed with the structural description of the constructs and their relationships. Participant agreement and disagreement with the models was analysed for bias due to technological framing associated with an individual's role and membership.

INFORMATION SYSTEM TECHNICAL ANALYSIS

Model one had implications for interpreting the technical system (in particular the client record) in BST. To test the claims represented in Model one, the researcher undertook an IS analysis of the BST information artefacts. The *National Accreditation Standards* manual, the *Data Dictionary* for the BSA Program, BST's Business Process Analysis Project Report ("current state" business processes, work flows and information flows) and the BST *Policy and Procedure* manual were analysed. The focus of the investigation was the data elements required in the client record and also standards for work practices measured by data recorded in the client record and/or documented in other places.

The researcher then used the data for an information systems analysis to see how client record data elements were used at various stages on its trajectory through BST and beyond to other entities, particularly the accrediting organisation, BSA. The analytic focus was the relationships between different types of data in the breast screening system from the perspective of the *nexus between accreditation and practice*.

The Business Process Analysis project provided models of all the workflows and data flows. The researcher developed a series of nine Entity-Relationship (E-R) diagrams to reveal the underlying technical perspective of the organisation. Combined, the data flow diagrams (DFDs), business processes and E-R represented the system architecture for BST.

E-R diagrams were developed for the artefacts used in activities related to accreditation and/or practice: the client record, client information system, NAS manual, BSA's *Data Dictionary* and BST's Policy and Procedure manual. The E-R diagram was drawn to show the relationships between the different types of client data and was focused on the client record. The researcher had access to the Business Process Analysis document showing how information flowed through the system for breast screening at BST.

The context level diagram for BST of actors and their roles was revised to identify major functions of the accredited breast screening enterprise, viewed as a system (See Figure 4-11).

E-R diagrams were developed to identify the content of data flowing through BST. E-R diagrams were constructed for the client record first (Figure 4-12). The qualitative data was revisited to identify additional artefacts for data records that were significant for accreditation-related activities and screening practice activities (Table 4-11). It was not possible to relate all the entities in the current system, and the researcher noted islands of disconnected entities (see Figure 4-13).

The researcher analysed the relation between the data collected onto the client record and any other information collected in the course of BST work activities to support: 1) practice; 2) individual accreditation and 3) organisation accreditation.

3.4.4 Critical Reflection

The researcher reflected on the implications of the *nexus between accreditation and practice* that incorporated non-alignment of the social and technical systems for delivering the screening and assessment health service in the BST setting. The researcher adopted a distinction between social systems and technical systems (see Section 2.4.1) and drew on literature from qualitative health research discussing the role and impact of information in health service contexts to answer the following questions:

1. What are the social consequences of the nexus between accreditation and practice?
2. What are the technical consequences of the nexus between accreditation and practice?
3. What are the implications of the insight that the social system for BST indicates partial integration of accreditation and practice (organisation and individual level) while the technical system indicates full integration such that client record data used to support clinical practice is the data used for organisation measurement and evaluation?

The second conceptual model was constructed to capture the insights/findings from phase three critical reflection. This model drew on the insights from a literature survey that identified the work of Mol (2006) and Berwick (2002) challenging technical and population-level conceptions of information purpose and use-in-practice.

3.4.5 Conceptual Models – end Phase three

The models were constructed using a social system and information system analysis followed by critical reflection on the implications of the *nexus*. The modelling process was iterative and kept open to different units of analysis by the PPT-heuristic. The second conceptual model was constructed in response to understanding that the client record was an important unit of analysis and that the IS analysis did not accord with the sociological analysis. Model two reframes the analysis to focus on the meaning of the client record data. The models together represented the outworking of the *nexus between accreditation and practice* embedded in the organisation design (work practice and information system implications).

Phase three concluded with an explication of the two conceptual models; the PPT-constructs adopted from different theoretical frameworks and the *boundary maintenance* and *institutional broker* constructs. The interpretation drew on the SSM principle of representing both social and technical (socio-technical) structures from a declared perspective.

3.5 BST case – Interpretation and Discussion

In Chapter 5, the researcher explicated the meaning of the *nexus* for the three units of analysis covered by the conceptual models from the perspective of information integration: the client record artefact; the technical information system (of things used in the BST setting to conduct the screening and assessment enterprise) and the organisation-wide socio-technical system (including interactions with the accrediting organisation BSA).

The conceptual models were interpreted to answer the substantive research questions (Section 1.2). The interpretation was based on the analysis products from iterative cycles of data collection, data analysis and critical reflection, concluding each phase with a transition analysis leading to the next phase. The interpretation of work practice and information system implications of the *nexus* for the BST organisation focused on the findings from the two models (Section 4.5.7).

The findings were then discussed in relation to ‘wicked problem’ issues highlighted by the literature review and relevant to the BST situation. This included the health system crisis (ageing population and IS/ICT driving efficiencies by information integration and work practice standardisation) and health system conflict (population-level EBM vs. individual-level patient-centred models for quality care delivery). The discussion was extended to comment on the research outcomes in relation to three concerns highlighted in the literature:

- Role and impact of IS/ICT in health service delivery and health service accreditation;
- Impact of IS/ICT design (information integration and work practice standardisation);
- IS research and utilising socio-technical perspectives.

3.6 Summary – Method

This chapter has described a three phase human-centred multi-method approach to studying wicked problems. An additional feature of the method, the PPT-construct, was used as a heuristic device to facilitate openness to sources and units of analysis for data collected as well as analytic perspectives for structuring the data. The method incorporates and builds on analysis outcomes that are specific to the research setting. Table 3-1 is an artefact of the research process that provides a way for structuring scientific research in a wicked problem setting that may be reusable in other domains. The next chapter sets out the data collection and analysis that resulted from the application of the method.

CHAPTER FOUR – DATA AND ANALYSIS

CHAPTER 4 DATA COLLECTION AND ANALYSIS

Chapter three presented the method of a three-phase multi-method approach to address setting with wicked problem characteristics. This chapter presents the data collection and analysis outcomes of the research for each phase of the research. The analysis outcome from phase three of the research is two conceptual models for analysing the problem theme identified in phase two: a *nexus between accreditation and practice*.

CHAPTER FOUR OUTLINE

Section 4.1 introduces Table 4-1 as an artefact and shows the analysis outcomes for the research method. It sets out the structured data products that are generated by the method for each phase and the concluding analysis leading into the next phase.

Section 4.2 gives a short introduction to the research setting, BST: its purpose, functions and the wicked problem properties, requiring a multi-method multi-phase approach.

Section 4.3 presents the data collection and preliminary analysis from phase one of the research activities for familiarisation and sense making using the PPT framework as a heuristic device.

Section 4.4 presents the data collection and analysis for phase two of the research directed toward theme identification. This includes identifying BST problems; the problem theme and initial PPT constructs grounded in the BST data.

Section 4.4 presents the analysis for phase three of the research focused on developing conceptual models of the BST situation using the problem theme (a *nexus between accreditation and practice*) as a lens. Two conceptual models are developed and the meaning of the problem theme articulated.

4.1 Introduction

Table 4-1 shows the primary products of the research activities for each phase. Different techniques produce different ways of structuring the data from different perspectives. In phase one the analysis products (structured data) provide a variety of structures for understanding and analysing the data. These form the foundation for the researcher's appreciation of the BST problem situation leading to phase two.

The analysis outputs from phase two are primarily organised in a series of tables that group different data into concepts and relationships. Some of these concepts are mapped to PPT-theoretical frameworks and constructs (Table 4-4); others emerge from the data and are further analysed in phase three. Phase two analysis concludes with the selection of a problem theme expressing the BST situation: a *nexus between accreditation and practice*.

This analysis is the basis of proceeding to phase three, conceptualising the theme into models that can be useful for IS design. Tables are presented that show the different ways of structuring the BST data set in terms of the *nexus*. A social system analysis produced Model one. The technical information system analysis is part of the

conceptual modelling and testing process. The outcome of the IS analysis is Model two. Combined, the two models provide a nuanced understanding of the meaning of the *nexus between accreditation and practice*: the meaning for the BST setting (Model one) and the meaning in terms of the client record as a designed information support artefact (Model two).

Research Question: What is the role of the information system in the functioning of a breast screening and assessment service in Tasmania and what is its impact?		
METHOD	RESULTS	
Research Phase	Structured Data Products	Analysis concluding a phase
Phase One: familiarisation and sense-making Activities <ul style="list-style-type: none"> • generating a data set; • documenting PPT trajectories; • describing activities; • drawing rich pictures • critically reflecting on key elements, relationships and perspectives. 	<ol style="list-style-type: none"> 1. Rich pictures 2. Work Flows and Data flows 3. Systems views of BST (social, technical): organisation and client perspectives 	Problem Situation Appreciation Key elements; relationships; perspectives Leading to → phase two
Phase Two: identifying a problem theme Activities <ul style="list-style-type: none"> • identifying problem stories; • mapping PPT constructs; • critically reflecting on the problems; • selecting a problem theme for further investigation. 	<ol style="list-style-type: none"> 1. Constructs and relationships (grounded in data; adopted from PPT-theoretical frameworks) 2. Theme: nexus between accreditation and practice. 	Problem Theme Identification Problem theme Leading to → phase three
Phase Three: conceptualising a theme Activities <ul style="list-style-type: none"> • researching key terms; • conceptual modelling; • testing conceptual models • critically reflecting in relation to model development. 	<ol style="list-style-type: none"> 1. Theme description and construct articulation 2. Model one: nexus between accreditation and practice 3. Test → DFD and E-R diagrams for IS artefact 4. Model two: information orientations for an integrated client record; Boundary maintenance construct 	Theme Conceptualisation Conceptual models; meaning of the <i>nexus</i> Leading to → Interpretation Models interpreted to answer research questions and consider implications for IS design Discussion <ul style="list-style-type: none"> • Health Service delivery and accreditation • Information integration and work practice standardisation • IS research and socio-technical perspectives

Table 4-1 Data products and analysis method

4.2 BreastScreen Tasmania

BST is a member of the national breast screening accreditation program, BreastScreen Australia (BSA). The program is a publicly funded population health initiative driven by a philosophy of prevention that also provides multi-disciplinary diagnostic clinical services to individual patients. It prescribes evidence-based 'best practice' for all work activities via 176 National Accreditation Standards (NAS); the standards include commitment to culturally appropriate individualised care for clients. It is quality assured via a system for accreditation that measures organisation performance by aggregated client data from the client information system and evaluates that data in the context of self-assessment reports and peer review of all professional workers (recruitment, administration, management, data and clinical). BST operates in an environment of health system rhetoric of 'health in crisis'; the demographic change driver of ageing population and IS/ICT promoted as an enabler and agent of changes for a sustainable health system

As such, BST is an organisation that must manage the tensions and competing forces that are common to most, if not all, health service delivery organisations: the health crisis in which an ageing population has compounding effects of a shrinking workforce and increasing target client population. It must also manage the tensions between population-based medicine and individual-based medicine and the role of evidence-based medicine in organisation performance and measurement and 'best practice' clinical guidelines. The role and impact of IS/ICT and information system design to support health work practices is also characterised by competing priorities and perspectives. This is particularly the case in the promotion of information integration and work practice standardisation affecting IS/ICT and organisation design.

Balancing a population health ethos with patient centred care

BST provides a breast-screening and assessment service to eligible women living in Tasmania. Women can register with the Program and attend a routine screening clinic in which x-rays are taken of their breasts to see if there is any evidence of cancer. For most clients, the outcome is a letter saying there is no evidence of cancer and that their next appointment will be in two years. A small percentage of clients each week receive a phone call from a counsellor encouraging them to attend a 'further assessment' clinic on the grounds that 'something suspicious' has been identified on their x-ray. These are the women whose lives may be saved by the detection of breast cancer before symptoms are evident. This good outcome is balanced by the fact that it requires a large number of well women to regularly submit to a clinical process that involves physical pain and psychological distress.

Staff shortages limiting capacity to meet participation rate standard for accreditation

The Program is a publicly funded population screening health service that also provides multi-disciplinary diagnostic clinical services to individual clients/patients. BST advertises its service under the tag line, "Tasmania's only accredited breast screening service". BST is a member of the national breast screening accreditation Program, BreastScreen Australia (BSA). This membership is very important to BST as its funding is dependent on maintaining its accredited status. However, clinical staff shortages and

increasing client demand mean that radiographers must speed up client screening x-rays to reach the required participation rate.

Patient-centred care in a population health program

BST staff members work very hard to ensure they deliver a high standard of care to clients (both population-level routine screening interactions and the highly personal, individual-level client interactions in the further assessment clinic). However, there are ongoing tensions over how best to organise and design work in order to meet the accreditation standards. The extent to which staff members have adopted the NAS into everyday practice is checked during an accreditation site visit.

The tension is most acute over what is best practice in the clinic context of multi-disciplinary clinical specialties and priorities of evidence-based decisions (population-level) and patient-centred decisions (individual-situation). These tensions are exacerbated by a shortage of clinical staff available to work in the Program (especially radiographers and radiologists) and an increasing client base due to the ageing population of Tasmania, placing pressure on staff to change the way they work – so that BST can meet accreditation standards related to productivity and cost-effectiveness.

The role of the client information system in delivering an evidence base

The BSA Program sets out requirements of evidence-based ‘best practice’ for all work activities via 176 NAS. The standards are the basis for assessing organisation performance via a client information system that is a database containing the client records of each registered client. Each organisation has a client information system for collecting and reporting client data that complies with a national Data Dictionary. The Data Dictionary enables standardised client data collection by all member organisations. The client information system is designed primarily to support BST in demonstrating compliance with the NAS. The paper client record is used in the clinics to support clinical practice and clients.

The tensions and perspectives present in the BST situation are indications that BST has the properties of a ‘wicked’ domain with implications for the role of its information support systems.

4.3 Phase One - the Problem Situation

From Table 4-1:

Research Phase	Structured Data Products	Analysis concluding a phase
Phase One: familiarisation and sense-making Activities <ul style="list-style-type: none"> • generating a data set; • documenting PPT trajectories; • describing activities; • drawing rich pictures • critically reflecting on key elements, relationships and perspectives. 	<ol style="list-style-type: none"> 1. Rich pictures 2. Work Flows and Data flows 3. Systems views of BST (social, technical): organisation and client perspectives 	Problem Situation appreciation leading into phase two Key elements; relationships; perspectives

Phase one is the result of sixteen extended observations over three months that included trajectories of interactions involving clients and client records and observations of staff members in the data, administration, recruitment and clinic areas of work. The observations were the foundation for the researcher's appreciation of a problem situation for BST that included the key elements, relationships and perspectives in the organisation.

4.3.1 Rich Pictures

Over 100 rich pictures were iteratively constructed during phase one, drawing on observation field notes, organisation documents and trajectories data to express different aspects of the BST situation. Rich pictures were sketched consecutively in Visual Art diaries, dated and numbered to form a chronological record of the evolution of the researcher's knowledge and understanding of the PPT-elements, perspectives and relationships connected to trajectories of client interactions with BST-people and BST-artefacts.

The researcher drew different kinds of rich pictures, depending on the purpose. Initial rich pictures aimed to put down everything the researcher 'knew' from the fieldwork. They were unstructured, messy and focused on noting any social, geographical, political and technical elements of the situation and relationships between people, place and things. They indicated gaps in knowledge requiring further data collection.¹⁸

Figure 4-1 is an early rich picture of BST as a unit within the Public and Environmental Health Service (PEHS) for Tasmania. Elements include: the geographical distributions of BST work with Tasmanian women (Hobart clinic, Launceston clinic, mobile clinic and locations for recruitment activities); some situations of client interactions with BST staff members (being educated about the service, booking an appointment, having a routine mammogram); the primary artefacts used in client interactions; communication with clients (letters, telephone, face-to-face); staff interactions with each other and the artefacts used in their work; political and social factors present.

¹⁸ A consequence of the 'quick and dirty' nature of rich picture drawing is that the products are generally low quality for reproducing as evidence in the context of reporting on research findings: they do not scan well into electronic format. The researcher acknowledges that Figures 4-1, 4-2, 4-3, 4-8, 4-12 and 4-13 are difficult to read: the originals are pencil drawings and thus the quality cannot be sufficiently improved for the purpose of readability, even by enlarging. The purpose of including them in Chapter 4 is to provide an indicative sample of the analysis products from this research from using the 'rich picture' technique.

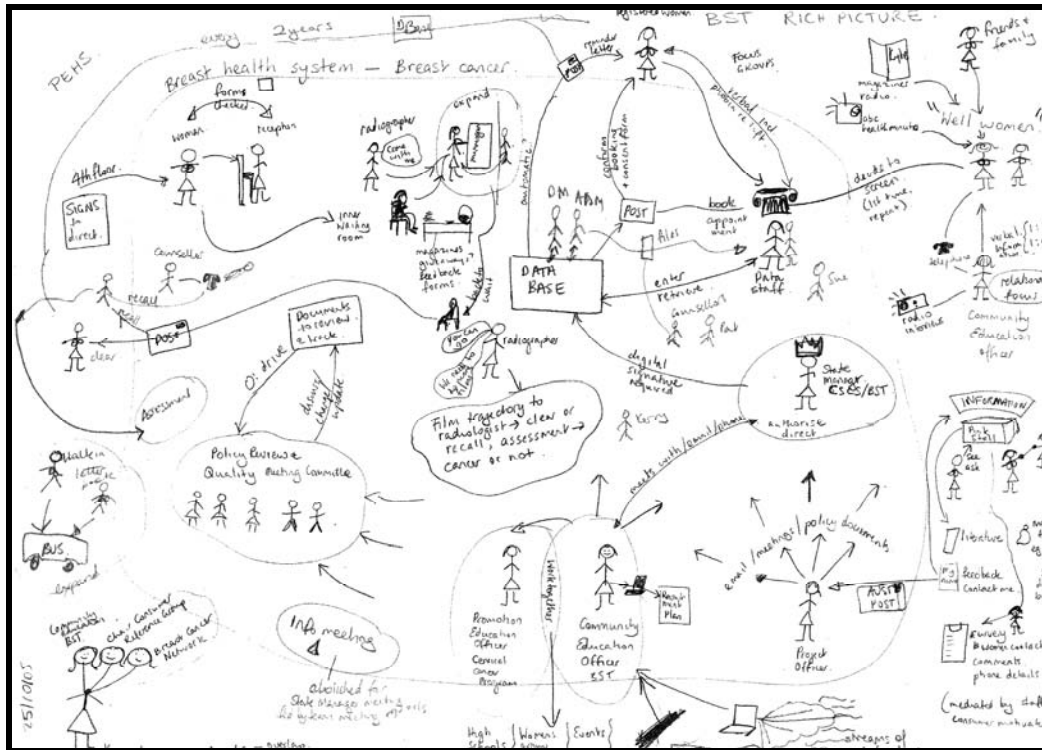


Figure 4-1 Geographical, social, technical and political elements/relations BST context

Figure 4-2 highlights the primary groups of people engaged in different activities and that the client record data is the link between their activities. Clinic based activities are separate from data area, administration and recruitment activities. Clinic based activities (delivering the health service) and recruitment activities (promoting the health service) revolve around personal interactions with a client. Clinic activities also revolve around recording and using data on a paper client record. Data area and administration activities revolve around the data on the client record in both paper and electronic forms. The Program Manager, Data Manager and Designated Radiologist jointly interact to monitor and manage the implications of aggregated client data reports for organisation accreditation. (Model two is recorded in this rich picture; was added during phase three analysis.)

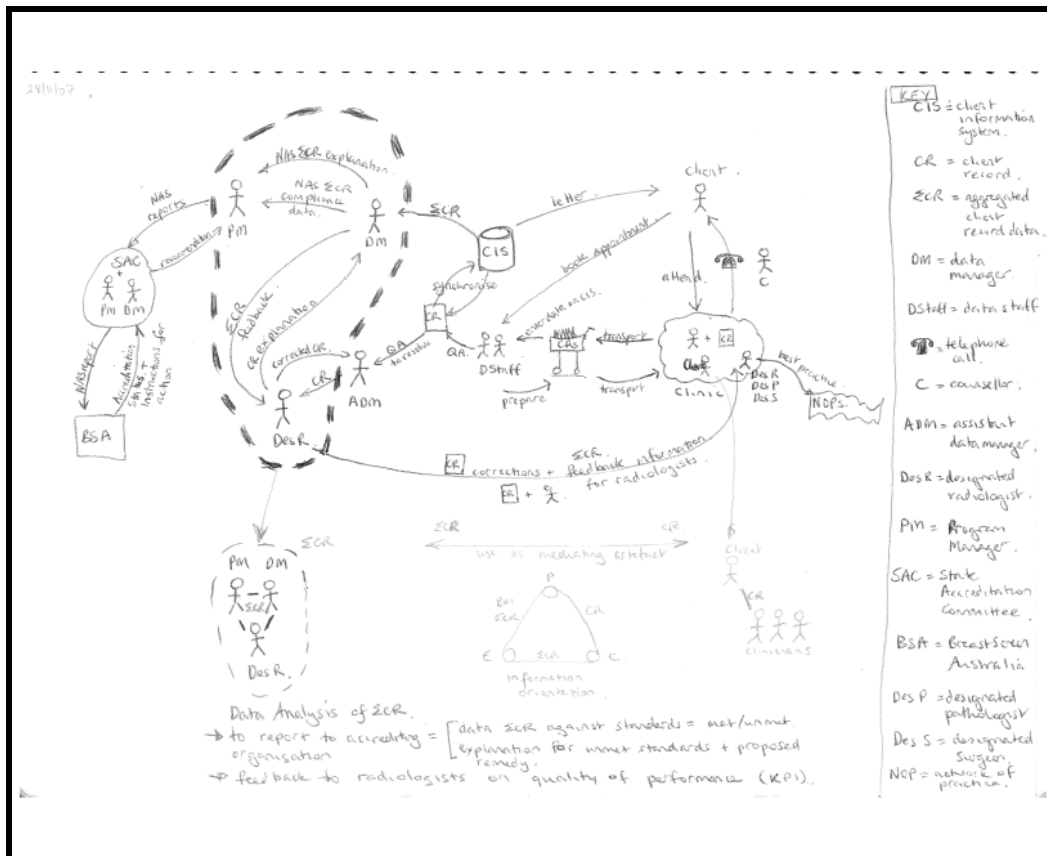


Figure 4-2 Rich Picture: BST data flows

No single rich picture represented all the details and insights into the organisation situation arising from the fieldwork but repetition of concepts and relationships for different levels of analysis and for different perspectives was an indication that the researcher had a sufficient appreciation of the situation. At this point, a summary rich picture was constructed to conclude phase one (see Figure 4-3). The summary rich picture expressed the researcher's understanding of the key aspects of the problem situation for BST and was done to aid transition into phase two and identifying a key problem theme for BST.

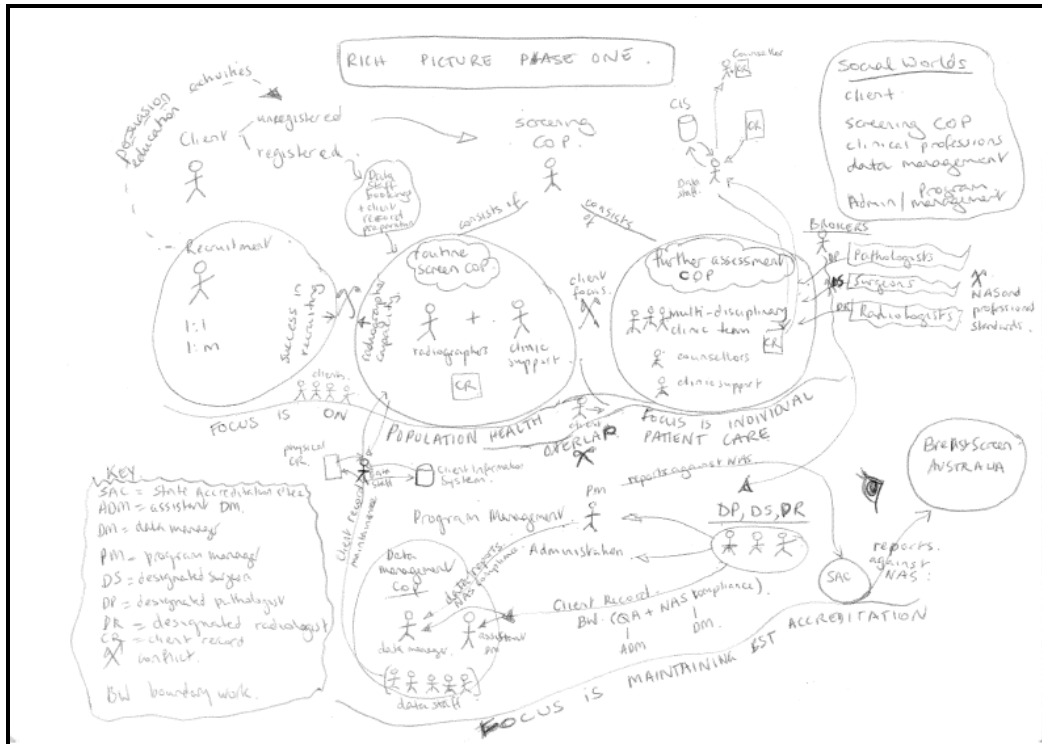


Figure 4-3 Rich Picture: key aspects from phase one

Figure 4-3 represented the people and things interacting in the course of conducting the BST enterprise. It shows different roles in the organisation and data flows for interactions and activities (involving clients, data area, clinic area, and management staff) and onto BSA. The rich picture expressed the conflicts evident in the research data particularly from analysis of problem-focused recurring conversations (see Table 8-5).

This rich picture highlighted that the client record was a key artefact to support client-staff interactions in the clinic. After each clinic, the client records were transported to the data area and used as a key artefact for work in measuring organisation performance and supporting meeting standards. Client record use in the clinic affected its use in the data area and *vice versa*. In addition, the effects of problems in either area extended beyond the boundaries in which teams worked to affect the ability of BST to conduct its enterprise of saving women from breast cancer and stay accredited.

PROBLEM SITUATION APPRECIATION

BST is situated in the context of its role as a health service organisation delivering population-level screening and assessment for breast cancer; part of a national breast-screening Program overseen by BSA. Its purpose is cost-effectively saving women's lives: both population-level and individual client/patient health service delivery is important, but prioritised differently within the organisation. Data collection is an integral part of clinic activities; data management is connected to the clinic work practices at several levels (data quality and completeness; data monitoring; data reporting) and dependent on them.

The constructs *community of practice* and *broker* (Wenger, 1998) represent social aspects of the clinic based activities (routine screen, further assessment and results clinics). Specialist clinicians (radiologists, surgeons, pathologists) are members of the screening and assessment community of practice. However, they have additional membership in their profession, requiring brokering activity to manage situations where the requirements for individual profession membership conflict with BST requirements for clinical practice specified or implied in the National Accreditation Standards (NAS).

The Designated Radiologist, Designated Surgeon and Designated Pathologist are particularly responsible to educate and persuade fellow clinicians to adopt the NAS into their practice. They do this primarily in the context of personal interactions (which they refer to as “collegial persuasion”) with fellow specialists (who, for example, may not be using ‘best practice’ techniques) and by a monthly multi-disciplinary meeting presented by the Designated Radiologist. This meeting is attended by BST clinical staff members, including counsellors, and is open to all medical doctors, not just those working for BST. Participants gain professional development points, which is a requirement of continuing membership in their clinical specialty.

The BST situation includes symptoms of stress and associated conflict issues. Stress symptoms include: certain staff members working chronically long hours; processing client record files in which backlogs is normal; radiographers taking workers’ compensation and stress leave; recurring conversations of complaint and resentment and difficult interpersonal relations. Conflicts are between clinic-located and data-located staff members or staff teams. Conflicts are expressed in making judgments about others’ work practices and work ethic.

The negative judgments are in the context of pressure for BST to meet the NAS and to continually improve performance standards for organisation accreditation. However, there are capacity issues for delivering clinical services and for processing client records within required time frames. Staff members frame breakdowns and bottlenecks in work processes in terms of the priority of individual client/patient care or the priority of ‘the greater good’ of a population-level client focus. Pressure on clinic staff members to increase screening and reading rates is met with clinician resistance on the grounds of requirements of belonging to a health service profession with its own standards for professional conduct: “we are not just technicians.” Table 8-9 is an example of a grouping of data related to perspectives and relationships between radiographer work practices and work practices of data staff and recruitment staff.

“It’s about how they do their screening and why they do their screening, and the objective of the program is to screen as many women as we can. ... it is about an appropriate blend of providing an efficient service It’s not about looking after one woman’s individual needs; it’s about looking after all women’s mass needs.”

Interview transcript, Program Manager

Staff members who work in the data area have two main tasks: 1) ensuring that client data is accurately and completely entered onto the client information system on time (data support and assistant data manager) and 2) reporting the aggregate of client data against the NAS using BSA supplied report templates (data manager). Data support staff members’ work is negatively impacted by inaccurate data entry on individual client

records and delays in the progress of the client record through linked activities in the clinic setting.

The data support staff members are highly constrained in opportunities to develop their work practices. As a group they do not have a vision to improve their work in order to contribute to the organisation enterprise and resist changes to work practices imposed by the Data Manager. In contrast, the clinic support staff members (with similar skill and responsibility levels) work closely with the multi-disciplinary collective of clinicians. They actively adapt work practices in order to facilitate better work flows and client experience. BST staff members who work in the clinic context identify and engage with the concepts of continuous development of work practices in response to client expectations and to achieve best practice clinical outcomes.

The Data manager, Designated Radiologist and Program Manager have the task of monitoring and taking control actions to maintain BST performance outcomes measured against the NAS. They prepare and present reports to the State Accreditation Committee (SAC), which is a committee of expert professionals who are responsible to oversee BST at jurisdiction-level (State/Territory). The SAC reports to BSA, making recommendations for accrediting BST based in the SAC's assessment of the quality of BST performance from the data reports taking into account local contingencies outside the control of BST that affect performance.

4.3.2 Work Flows and Data Flows

There are two distinct work activities within BST performed by different groups of staff members, working in separately located areas. The client record (paper) is the artefact linking the two activities and is physically moved between different locations.

Workflows in BST are dominated by the data collection and processing requirements for the client record (paper and electronic versions). Workflows related to delivering the screening and assessment service cannot progress until data from the paper client records has been manually entered onto the client information system. (See Figure 4-4)

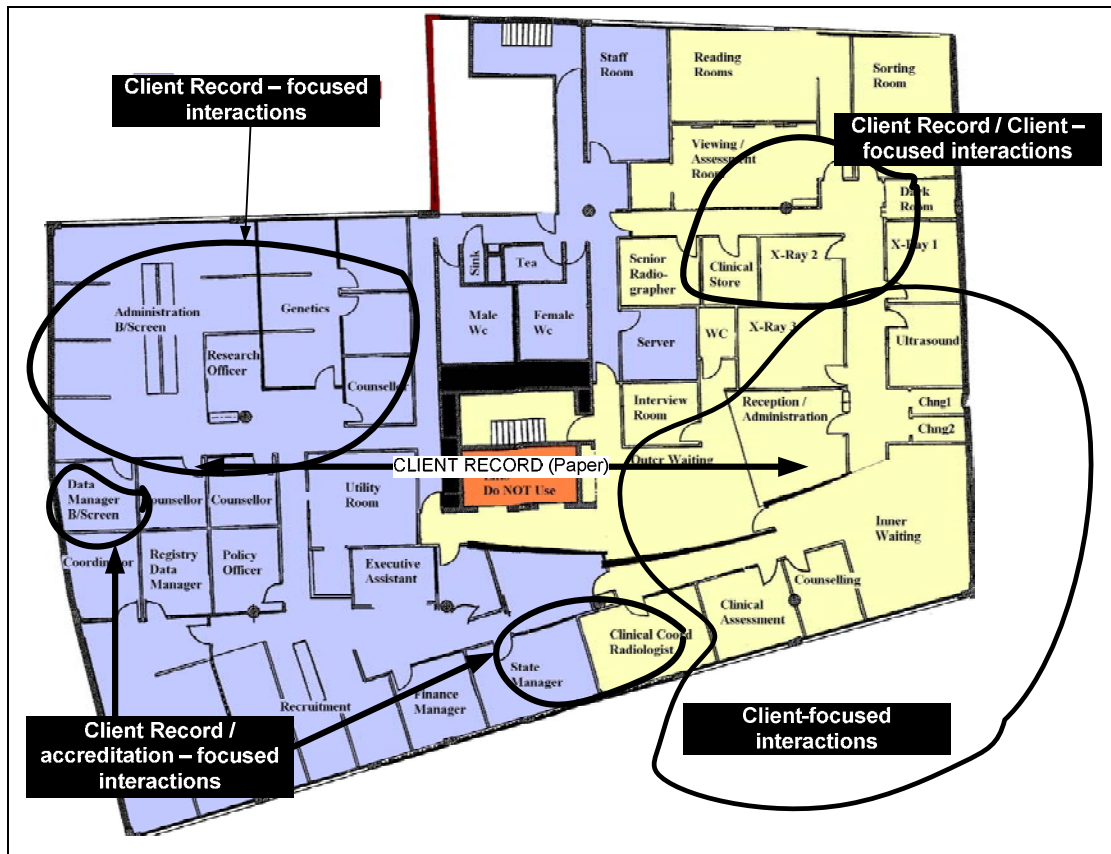


Figure 4-4 BST Hobart office – focus of interactions for different work areas

In Figure 4-4 the darker area corresponds to the secure data and administration area; the lighter area is the clinic area. Batches of client records (grouped by appointments for a clinic) are transported by trolley (or couriered from mobile and Launceston clinics) to and from the data area and the different clinic areas (Figure 4-5). Client records that are identified by data support staff as incomplete, have inconsistent data or indicate a failure in quality of service are given to the Assistant Data Manager (data quality issue), Data Manager (unexpected data value) or Designated Radiologist (clinical practice quality, data completeness).



Figure 4-5 Client record transport

Figure 4-6 is a human activity model of BST activities for a standard client trajectory. Clients either experience one or two cycles of interactions: routine screening clinic and (if they have a 'suspicious' x-ray) attend a 'further assessment' clinic, concluded with a 'definitive diagnosis'.

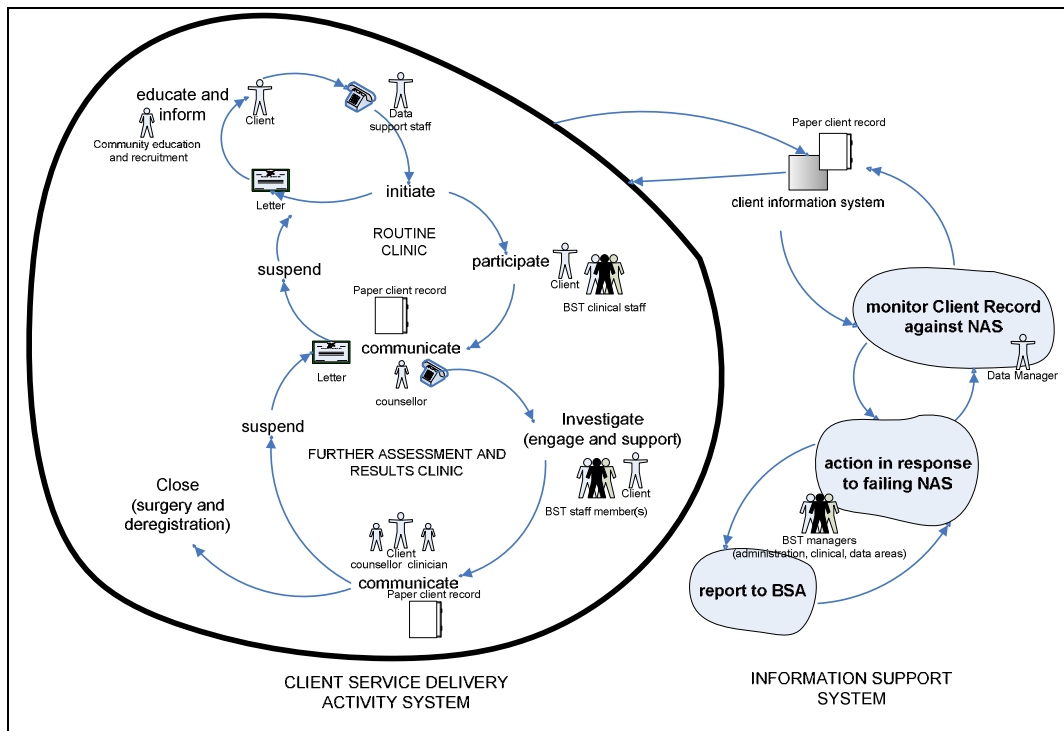


Figure 4-6 Activity system representing PPT-interactions between clients and BST

The BST information system supporting clinic activities is focused on the paper client record. The client record artefact enables the multi-disciplinary team of clinicians to record client data and clinical outcomes in a single location (paper client record). The client record is the focus of discussion and clinical judgment by clinicians during an assessment clinic. Clinically interesting or problematic client records are discussed in multi-disciplinary professional development meetings.

A major task for data support staff members is manually entering client data from the physical client record onto the electronic client information system. Each synchronisation interaction is potentially an occasion for work system breakdowns involving individuals, work teams and the management staff of BST: breakdowns which prompted problem-solving discussions in staff meetings and reports related to accreditation compliance.

All clients participate in the routine screening activity and screening capacity is a major bottleneck for the other activities that flow into and out of a routine clinic. Several radiographers took stress and holiday leave in response to pressure to screen clients more quickly. This flowed through to affect the work of data support staff members responsible for client bookings.

[Name] asked a data staff person how she was going. [The person] was upset because they had to do 160 rebookings because of changes in the radiographers' work shifts, which put them behind and was also very hard to do: "One lady's appointment had to be changed twice!"

Field notes, Data support staff observation

The information support for non-clinic staff members' activities is provided by the client information system (electronic client record). The client information system enables data support staff to directly enter client data for clients booking an appointment or print clinic appointment lists. Management staff members (data, clinic and administration managers) use the client information system to monitor and report BST performance against the NAS set for organisation accreditation.

The central activity in BST is delivering routine screening and follow-up assessment services and occurs in the clinics. There are several PPT-interactions that connect at the boundaries of clinic activity and flow on to other activities, on which clinic activities subsequently depend. Other activities are primarily processes focused on the client record: client records must be prepared for a clinic (before routine or assessment clinic); prepared for radiologists to read films (after routine clinic) and prepared for data support staff (after films are read) to enter data on the client information system.

Thus, at the finish of 'in-person' PPT-interactions with a client (in the clinics), the focus of BST work activities switches to the client record. The activity of recording client data is the second major activity in BST. This activity involves clinical staff members recording data onto the client record and data staff members working in data staff area transferring the data onto the client information system, "quality assuring" the data entry and producing reports against NAS. Artefacts related to complying with the BSA Program's NAS were integral to this system of work practice.

Organisation performance outcomes are used to evaluate client experience of interactions with the service organisation in relation to:

- education and information;
- initiating appointments;
- participation in the Program;
- interactions during a clinic;
- communication;
- time frames;
- clinical outcomes.

Data reports are constructed in relation to appointments, participation, time frames (for various steps in the clinical pathway) and clinical outcomes. In particular the NAS standards check timeliness of communication and quality of diagnostic tests and (based on outcomes of surgery) correctness of diagnosis. Organisation performance measurement is primarily from client record data and 'non data' NAS are audited on the occasion of an accreditation site visit. The client information system database is queried to generate reports on organisation performance against the metrics defined in the NAS.

From an organisation perspective, BST's accreditation relies on the accuracy and completeness of each client record, as well as the quality of the judgments made by

clinicians. The data area staff members are focused on the client record as the primary artefact for demonstrating compliance with the NAS. It is important for data support staff and the assistant data manager that each individual client record is accurate and complete.

Her current problem was that she was trying to quality assure (QA) data entry from a client file ... the Assistant Data Manager told me QA is difficult because in a data job, "the data has to be good, especially in a place like BreastScreen, where your data is scrutinised minutely, and if something is wrong, the first question they ask is, 'What else is wrong?' and you don't want to go there".

Field notes, Assistant Data Manager observation, August 2005

The NAS requirements for clinicians to fill out forms in the client record completely are not always congruent with the clinician's personal information requirements to record the data that is necessary for clinical judgments. The designated radiologist is responsible for individual client record clinical data entry and client records with missing or inconsistent data are delivered to his office each week by the assistant data manager for correction before the data is entered onto the client information system.

"They've [client records] been filled in, but they haven't been filled in properly. You see, it's very, very easy to miss bits and pieces as you're going through. ... I mean it sounds a bit daft to do all this. The last lass who was doing [the assistant data manager] job used to do it for us, because most of them are obvious, but [name] basically says, 'It's your job; I don't want to enter stuff without (XXX) ((spoken very quietly)). ... It drove me nuts initially, but I think its crap in, crap out isn't it? And if you don't put the right stuff in, mind you, we're not getting much out either are we?"

Interview transcript, Designated Radiologist

The Designated Radiologist is the leader and a member of the clinic *community of practice* in BST. He also uses his skills and knowledge in other health service delivery contexts and *communities of practice* due to his membership of the *network of practice* for accredited radiologists. He has a *brokering* role as part of his employment as Designated Radiologist. This role is an element of the BSA requirements for its member organisations. Embedded in the NAS, it is a mechanism for assuring that the 'best practice' clinical guidelines are part of the everyday practice of clinicians working for BST. The Designated Radiologist is also expected to decide on and communicate changes to clinic work practices. He is the liaison person for coordinating the use of the client records between the data and clinic areas and between the administration and clinic areas.

It is important for the Data Manager and the Program Manager that the aggregated client record data demonstrates compliance with standards. There are 176 NAS standards. Most of the NAS are measured using data elements in the client record (which comply with the *Data Dictionary* defined by BSA). Accredited organisations must supply an annual data report that is calculated using approved algorithms. The Data Manager continuously monitors the data on the client information system for evidence that BST is continuing to meet standards and particularly to identify standards that are not met, or where compliance is trending downwards.

“NAS data reports involve a hell of a lot more than simply generation of database reports - all the exceptions/oddities are individually examined, files are hand checked, and occasionally results are sent to the multidisciplinary committee for review and action. For instance, if we record a positive core biopsy result but enter that the client did not receive surgery, this comes up in the NAS report query as a false positive due to limitations in the database and algorithms. An alternate algorithm might show such cases as ‘incomplete’; however this might still not be correct.”

Email to researcher from Data Manager

The Designated Radiologist, Data Manager and Program Manager work together to monitor and take action on organisation performance standards. Standards compliance is treated as a risk management issue and client record data can be investigated both at the level of individual records and aggregated client data for a specific data element. They meet frequently (as needed) and formally (each month) to discuss the details of individual client records that are negatively contributing to a standard compliance measure. The meetings are also used to generate explanations for unmet standards to be presented in reports (initially to the SAC and then the National Quality Management Committee heading BSA). The SAC consults with the Program Manager and approves or recommends actions to improve the ability of BST to meet standards that are trending down or failed. Actions can involve decisions to change clinical practice, data management processes or the format of the various forms that comprise the client record.

When working together, the Designated Radiologist, Data Manager and Program Manager do not have the properties of a *community of practice*. The activity is one of brokering, of engaging in discussion and negotiation that results in transferring elements of practice from one community to another. Thus, they make decisions affecting how work practices of other staff members and teams are organised. These decisions are imposed on members of the clinic *community of practice* and other staff members (data support, clinic and recruitment). All decisions are predicated on the expectation of enabling or ensuring compliance with the NAS.

In this context, the NAS is a technical structure in the setting that constrains these staff members as leaders to collaboratively develop and actively implement a system of work activity to: *Monitor* activity outcomes; *Evaluate* outcomes against the metrics in the NAS; note and respond to any trigger to take *Action* and *Report* NAS compliance, remedial actions and outcomes (see Table 4-2).

Monitor	Evaluate	Action	Report
Individual client record quality and aggregated client record data measured against NAS metrics	Compliance with NAS or specific NQMC directives. Identify causes and control actions that can be taken to facilitate compliance; construct explanations for situations where action problematic.	Change work processes or policies; instruct staff members about NAS implications for current work practices	Formal reports to Tasmania’s State Accreditation Committee and to BSA’s National Quality Management Committee.

Table 4-2 BST activities focused on the National Accreditation Standards

The analysis shows the *priority* of accreditation-related data collection and analysis for the organisation. At the level of the national breast-screening *enterprise*, BST is part of an accrediting system for over forty breast screening service organisations; its membership in this system determines the data it collects from clients and the focus of data collection and information management is ensuring compliance with BSA requirements. Client interactions are done in accordance with NAS specifications and measured via data collected on the client information system. Performance reports to government departments are based on and adapted from information gathered for BSA accreditation. This data analysis contributed to the insight that a *nexus between accreditation and practice* as an organisation-wide theme.

Figure 4-7 represents the data flow for BST from a data flow (process) perspective. BST (viewed as a *breast-screening* information system) interacts with external entities in its environment. BST exchanges information with individual CLIENTS, BREASTSCREEN AUSTRALIA and the Tasmanian State and several Federal GOVERNMENT DEPARTMENTS. Organisation reports are generated from aggregated client data and letters to individual client are generated from the client record held in the client information system database.

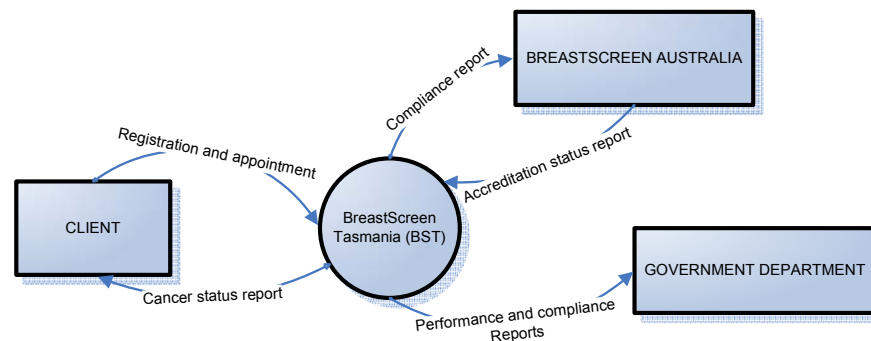


Figure 4-7 Information System view of BST context level data flow diagram (DFD)

From the information system (data processing) perspective the client is ‘outside’ the BST boundary. However, client trajectories data indicated a social system in which the client is an integral member of the screening and assessment process, cooperating with BST staff members and participating in (sometimes challenging) decision-making (Wales et al., 2002), particularly in the assessment clinic context (see Figure 4-3).

4.3.3 BST – Client interactions

BST interactions with clients are structured by the NAS requirements, which control the activities, sequence and timeframes of staff member actions as well as measuring the outcomes via the client record/client information system. The NAS requirements are designed to deliver a client/patient-centred health care service at population-level. The view of the client is tightly defined from both a social and technical viewpoint.

Table 4-3 summarises different perspectives on BST clients considering the BST organisation as: 1) a social system and 2) a technical information system for screening women for breast cancer. It also summarises 3) client behaviours that challenge the organisation viewpoint on the attributes of their clients and what is best for clients.

The *social system* organisation view is based on data collected using a range of analytic lenses for observing activity involving PPT-interactions including a client record/ client information system, analysed using qualitative sociological techniques. The *information system* organisation view is based on data collected with a focus on the information system that supports the screening and assessment health service enterprise, analysed using SSM techniques and IS data modelling techniques. Trajectories data and observation/participant observation data was the basis of identifying client perspectives (indicated by behaviours that challenge the organisation system views).

	Perspectives on Client-Organisation Interactions
<p>Organisation View: Social System for screening women for breast cancer</p>	<ul style="list-style-type: none"> • Individual clients requiring “further assessment” interact by telephone with counsellors and then in person at the clinic as participant decision maker with a multi-disciplinary clinical team; • personal interactions with radiography staff are highly constrained by the requirement of structured tasks (breast x-ray and recording client data) to be performed in short time frames; • The clinical pathway for an individual called back for further assessment is structured and has routine elements, but the clinic staff members’ perspective of clients is focused on individual care and informed decision making. [‘inside a bubble of care’]; • Individual pathways are situated in the psychosocial status of the client as well as the clinical data collected by various diagnostic tests. • There are two primary and distinct social groups in BST (clinic staff and data staff) • There are two distinct systems of activity in BST (clinical service to clients and management of client data); • The work synchronising data on the physical client record with the digital client record is done manually by data support staff and their workload is affected by the clinic activities; • The client record data is monitored by data managers and clinic managers against organisation standards performance requirements (NAS); • Organisation standards performance (status and trends) is discussed with the Program Manager and changes in work practices negotiated.
<p>Organisation View: Information System to support screening women for breast cancer</p>	<ul style="list-style-type: none"> • Clients eligible for registration with the Program are well-defined and no exceptions are allowed; • Client interactions at the organisation boundary occur via letters generated by client information system and then telephone call for a screening appointment taken by a data staff member responsible for entering client data onto the client information system; • The clinical pathway for a routine breast-screen and possible further assessment is a well-defined process and highly constrained by the requirement of structured tasks to be performed according to best practice guidelines within defined time frames; • The data collected is defined by the National Accreditation Standards (NAS) and the National Data Dictionary; • The physical client record data must be synchronised with the data on the client information system and quality checked for accuracy and completeness.
<p>Client View: Client behaviour challenging the organisation view on screening</p>	<ul style="list-style-type: none"> • Turning up for a breast screen without an appointment; • Taking an inter-state holiday immediately after a routine screen (not available for further assessment) in Tasmania’s capital city, Hobart; • Asking for a screening appointment because of symptoms (BST is for asymptomatic women); • Client complaints (phone calls and letters) when did not get service expected.

Table 4-3 Perspectives on client interactions with BST

The social system for conducting the BST enterprise is configured as multiple social groupings engaged in different, occasionally competing, but interdependent activities (with breakdowns, bottlenecks, 'work arounds'). Different social configurations of work groups have different characteristics: some work groups are defined organisationally as teams (data, administration, recruitment, clinic support, radiographers); some work groups have the properties of a learning *community of practice*, and members of an organisation team can also be members of the *community of practice* (all staff members who take part in multi-disciplinary assessment clinics). *Multi-membership* was a property of the *screening community of practice* as each clinician was also an accredited *member* of a profession (Brown and Duguid's (2000) *network of practice*).

The technical information system supporting BST purposes and activities consists of structures and processes that include standards for work practices, information support for the BST enterprise and performance measurement of the organisation: all linked to the client record.

Clients exhibit challenging behaviours that indicate expectations of the BST health service that are not met. Many of these expectations cannot be met because of the structural requirements of the NAS, for example the client records is owned by BST, although clients can apply for a copy of their record under freedom of information legislation. Client records must be kept for accreditation purposes; clients' data is not readily or completely transferable to other jurisdictions. If a client transfers to another jurisdiction (e.g. NSW) she must be discharged from BST, registered with BSNSW and start a new client record. If her previous films are needed for comparison with current x-rays, they must be copied and couriered to the requesting screening organisation.

4.3.4 Concluding Phase one

The rich pictures developed in phase one were analysed to construct a rich picture and accompanying description that represented the researcher's subjective understanding of key elements and aspects of the problem situation in BST (Figure 4-3). This included that the role of BST as a service health organisation delivering population-level screening and assessment for breast cancer (cost effectively saving women's lives). BST exhibits the following tensions, opposing forces and conflicting perspectives (wicked characteristics):

- Conflicts between clinic-located and data-located people;
- Problems of performance standards issues for organisation accreditation linked to capacity issues for delivering clinical services;
- Client-organisation interactions that challenge the organisation view of clients;

The work flows and data flows were interpreted and represented as an activity system consisting of PPT-interactions between the clients and BST organisation in Figure 4-6. A context-level DFD, consisting of BST and external entities to which it has reporting obligations (CLIENT, BREASTSCREEN AUSTRALIA and GOVERNMENT DEPARTMENT), was also developed (Figure 4-7). The data was further interpreted for two organisation views (social system for screening women; information system to support screening women for breast cancer) and the client views challenging the organisation views in Table 4-3.

PPT-interactions operating in BST can be described in terms of the following characteristics:

- Work flows dominated by the data collection and processing requirements for the client record (paper and electronic versions);
- A social system for conducting the BST enterprise, in which multiple communities of practice engage in different, occasionally competing, but interdependent activities (with breakdowns, bottlenecks, work arounds);
- A technical system of structures and processes that includes standards for work practices, information support for the staff members engaged in BST breast-screening enterprise and performance measurement of the organisation: all linked to the client record.

The analysis identified that the trajectory for BST clients is tightly coupled with the trajectory for their individual client record. The client record trajectory involves physical travel between two distinct groups/teams within BST (clinic area and data area) and is the locus of tension between them. The client record trajectory is regulated by externally *imposed* standards (the NAS), specifying data collected, timeframes and work practices that are measured to evaluate the quality of defined aspects of client service delivery. Client record data reports are *monitored* against NAS metrics both internally by BST managers and externally by BSA overseeing committees. BST is required to maintain ‘accredited’ status and the problem solving within the organisation is focused on and driven by the requirement to comply with the NAS.

4.4 Phase Two: the Problem Theme

From Table 4-1:

Research Phase	Structured Data Products	Analysis concluding a phase
Phase Two: <i>identifying a problem theme</i> Activities <ul style="list-style-type: none"> • identifying problem stories; • mapping PPT constructs; • critically reflecting on the problems; • selecting a problem theme for further investigation. 	<ol style="list-style-type: none"> 1. Constructs and relationships (grounded in data; adopted from PPT-theoretical frameworks) 2. Theme: nexus between accreditation and practice. 	Problem theme identification leading into phase three Problem theme

Phase two is the result of analysing over five months of data collected from weekly observations, eleven semi-structured interviews and a range of organisation documents. The data analysis led to the insight that a significant problem situation for BST was associated with problem stories connected to the requirement for organisation accreditation within the BSA Program.

The organisation work practice and information support arrangements were designed to enable BST to conduct its breast-screening health service enterprise (saving women’s lives from breast cancer), and also to generate evidence that the health service is delivered to specified performance standards. Conflicts in the setting were strongly

connected to perspectives and activities focused on accreditation (measuring and reporting) and clinical practice (delivering the screening and assessment service).

4.4.1 Constructs and Relationships

PROBLEM STORIES AND CRITICAL REFLECTION

Problem stories and conflicting perspectives identified in phase one mapped to constructs and relations articulated in three PPT-theoretical frameworks: Distributed Cognition, Communities of Practice and Activity Theory.

The constructs from (Wenger, 1998): *community of practice*, *membership*, *broker*, *boundary object* describe properties of the clinic area and the work done around the paper client record artefact to manage the difference between data required for population-level, organisation performance monitoring and data for individual client situations. Distributed Cognition theory construct describes the role of the paper client record as a *cognitive artefact* for shared decision making in the clinic practice context, but the data on the client record outside the clinic context better reflected the properties described in the construct *boundary object*. BSA's *National Accreditation Standards Manual* (2002) expresses the expectation that the NAS will be *naturalised* into everyday practice of clinicians.

"Accreditation standards assist Services to incorporate into everyday practice the essential principles of a quality improvement program."

(Forward, National Quality Management Review Committee, 2002)

Data that did not map to PPT-theoretical frameworks or constructs was the work of the Designated Radiologist (and Designated Surgeon, Designated Pathologist to a lesser extent) in conjunction with the Data Manager and Program Manager. His role had *brokering* properties (introducing the NAS requirements for 'best practice' into the screening and assessment *community of practice*) but also had other properties due to the authority attached to the brokering role. His role involved boundary-crossing activities focused on the data in individual client records from a clinical perspective and data from a population-level, data management perspective (data on the client information system aggregated into reports). Aspects of this role were later described as *boundary maintenance* by the researcher.

Tensions and conflicts related to the goals or objectives of different centres of activity were identified from the data. The BSA Program has a nation-wide objective for the activity of screening well women (no symptoms) for breast cancer: cost-effectively saving lives. This objective can conflict or be incongruent with the objectives of individual clinicians in treating patients on a case-by-case basis. Each screening and assessment organisation like BST has the objective of delivering a well-defined clinical service to target clients in a population health context. This can conflict or be in tension with the objectives of individual clients with expectations for patient-centred care.

Table 4-4 is the analysis from critical reflection on the problems and perspectives in the setting and insight provided by the PPT-theoretical frameworks. Different aspects of problems were related to PPT-theoretical perspectives, PPT-relations and PPT-constructs.

PPT-Theoretical Framework	CRITICAL REFLECTION: identify problems and perspectives	PPT-RELATIONS	PPT-CONSTRUCTS
DISTRIBUTED COGNITION (Hutchins, 1995a)	<ul style="list-style-type: none"> Problems around the artefact-individual and artefact-team interactions (client record trajectory) The relationship between absence of career trajectory for data staff members and problems with data errors. Role of the NAS as artefact in development of client record as a cognitive artefact and cultural artefact shaping BST social organisation (standardising work practices) <p>TENSIONS and CONFLICTS Different attitudes to client record purpose and data quality and completeness</p>	<ul style="list-style-type: none"> Cognition as cultural Artefacts as mediating cognition Work practice systems as distributed cognition and context for learning and error checking Moment of practice (developmental perspective) 	COGNITIVE ARTEFACT → BOUNDARY OBJECT
COMMUNITIES OF PRACTICE (Wenger, 1998)	<ul style="list-style-type: none"> Integrating community of practice artefacts (reified practice) and artefacts imposed by the institutional structure of the accrediting organisation, BSA; Work required in maintaining or creating boundary objects for communicating with other COPs in BST or social configurations external to BST <p>TENSIONS and CONFLICTS Conflicting effects of individual multi-membership on developing organisation-level competency for conducting an enterprise;</p>	<ul style="list-style-type: none"> Knowledge production in communities of practice Multi-membership Boundary Objects Brokers Constellation of practice Trajectory into membership 	COMMUNITY OF PRACTICE MEMBERSHIP BROKER BOUNDARY OBJECT
ACTIVITY THEORY (Engeström, 1999)	<ul style="list-style-type: none"> Adopting BSA artefacts and standards into the system of work practice (RESPONSE: acceptance and resistance) Problems around NAS rules and BSA tools and best practice compliance by BST workers; Inter-team conflicting perspectives on participation rate problem and possible solutions (blame attribution) <p>TENSIONS and CONFLICTS National BSA Program objective → screening well women for breast cancer to save lives at population level <i>in tension with</i> individual clinician objective to treat a patient → BST objective well-defined clinical service to target clients in population health context <i>in tension with</i> individual women with expectations for patient-centred care.</p>	<ul style="list-style-type: none"> Activity/ action/ operation distinction and relations Subject/object mediation by rules, instruments, division of labour, community Multiple perspectives Breakdowns, disturbances, contradictions Trajectories of activities (developmental process) 	NATURALISATION OF STANDARDS AND TOOLS INTO PRACTICE CONTRADICTION of RULES: organisation-level accreditation and individual accreditation

Table 4-4 Critical Reflection and PPT-theoretical frameworks

RICH PICTURES AND PPT-THEORETICAL FRAMEWORKS

Mapping PPT-theoretical frameworks onto rich pictures provided constructs for describing elements or aspects of the BST situation that were grounded in the field data. PPT- perspectives also identified meaningful relationships between constructs that described the data.

Figure 4-8 is a set of analyses for different units of analysis incorporating constructs and relationships from Communities of Practice framework into rich pictures. Figure 4-8a represented the different social worlds operating in BST office: clinic, data and administration and the client record acting as a boundary object between the clinic and data activity areas. The clinic work activities are conducted by staff members cooperating and developing their practice with the properties of a *community of practice*. It identifies that there are staff members (managers, recruitment) that do not work with others as a community of practice: their role involves working collaboratively making decisions to which a community of practice must respond and change its practice.

Figure 4-8b focused on interactions between the data and clinic social worlds. The client record functions as boundary object between the data and clinic areas, meeting both their information needs. Conflict between data and clinic areas is focused on the client record and the NAS. Paper client records that don't meet quality assurance requirements (inaccurate, incomplete) are returned to the Designated Radiologist for correction. Client records that represent a failed standard are suspended from normal workflow processing. They are discussed between the Data Manager, Program Manager and Designated Radiologist focusing on what changes need to be made in the data or clinic areas to address the failure. Clinical issues are referred to a multi-disciplinary clinical meeting for decisions on changes to clinical practice.

"One of the great things about the NAS in BreastScreen is you're dealing with the same bunch of people. So there's a pathologist, designated pathologist, radiologist and surgeon. And they are responsible for their bits and the liaison with each other at the multi-disciplinary meetings which we have, just administrative multi-disciplinary meetings."

"... [The Program Manager] comes along to our meeting too and we have a multi-disciplinary meeting with a representative from the counsellors too and the senior radiographer. So it's a meeting which is very important. Mind you, because in this particular situation we are all so close together, most of its done before the monthly meeting, because the senior radiographer will come to me if there's something she wants, or go to [the Program Manager], and we have our weekly meetings."

Interview transcript, Designated Radiologist

The paper client record also functions as *reified practice* in the clinic context and different forms for data collection were occasionally modified and rearranged to better suit the workflows and information support needs of staff members in the clinics. It also has properties of a *boundary object* within the multi-disciplinary community of practice where it is used for recording client data used in discussion to build a shared interpretative judgment of the client's health status among clinical specialists, and also in discussion when there are problems with a particular client record or use of the client record.

The NAS is the authoritative source of ‘best practice’ for clinical practice in breast screening and assessment. The Designated Radiologist has a brokering role within the clinic to ensure that the clinicians and other staff members who work in the clinic context adopt its requirements. The Designated Radiologist, Designated Surgeon and Designated Pathologist role includes the expectation of promoting the NAS for clinical practice to all members of their clinical specialty, particularly those who work intersects with BST operations (for example, surgeons who accept referrals from BST clients diagnosed with breast cancer).

Figure 4-8c represents interactions between BSA and BST, again focused on the client record. In this case the Data report (aggregated client records performance measurement) is the boundary object between the two organisations: the health service enterprise organisation (BST) and the accrediting organisation (BSA).

Communities of Practice constructs and relationships (Wenger, 1998)

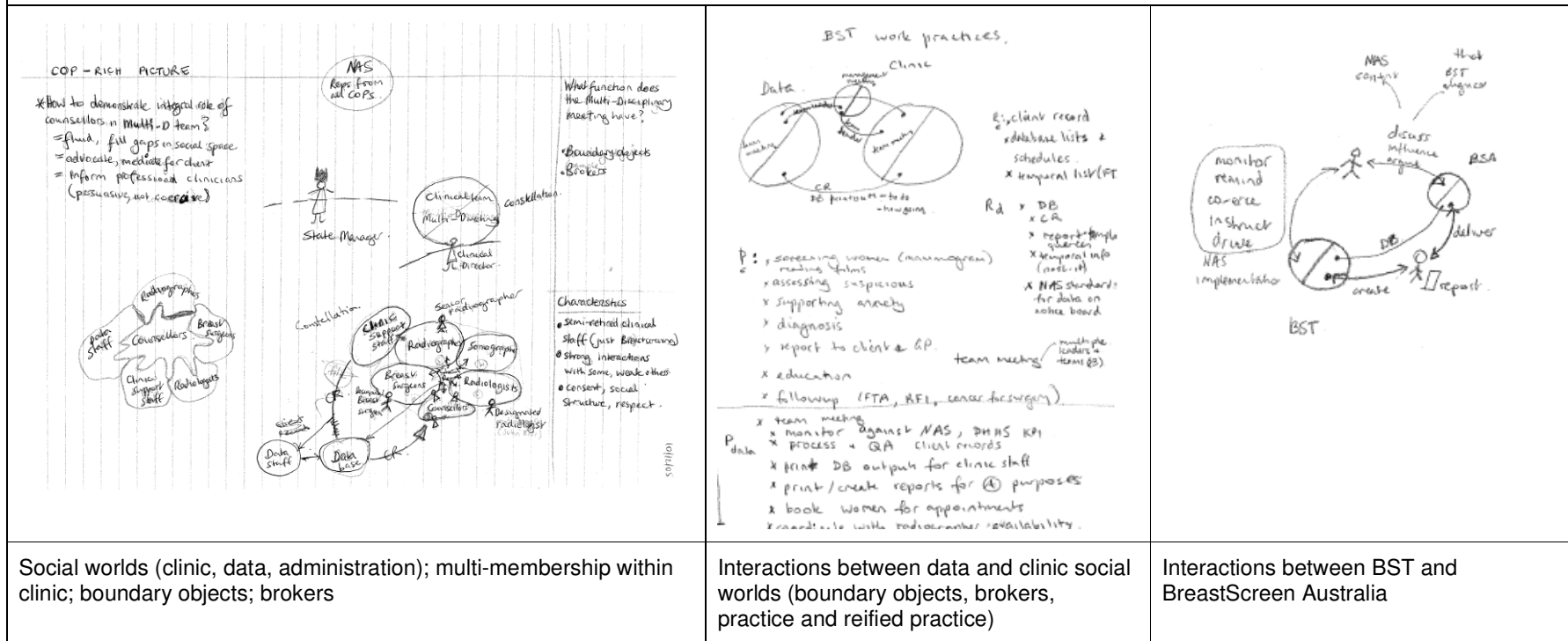


Figure 4-8 Rich pictures incorporating Community of Practice perspectives

4.4.2 Theme: Nexus between Accreditation and Practice

Table 4-5 sets out the actors, the primary focus of their activities and the artefacts they use to support their activities as part of the BST health service delivery enterprise. It highlights that the actors' focus is on organisation-level accreditation or on developing professional practice (individual work practices or the clinical team practices). The Designated Radiologist's focus is on the interplay between organisation accreditation and work practices in the clinics – creating an environment in which clinic work practices are equivalent to NAS best practice standards.

Different BST activities exhibit different ways of using the client record data and different perspectives on the purpose of the client record (either as a physical artefact and/or in its digital form on the client information system). In particular there is a different *focus* when using the client record for staff members engaged in client data analysis from an organisation management perspective (Data Manager, Program Manager and Designated Radiologist) in contrast to other work within the organisation, particularly use of the client record in clinics (radiographer, radiologist, surgeon, pathologist, clinic support staff).

HUMAN ACTORS	ACTOR ACTIVITY FOCUS	BST SUPPORTING ARTEFACTS
Client	My experience and expectations of health service delivery	Client Record (partial); telephone; letter
Data support staff members	Accreditation (organisation)	Client Records; Client Information System; telephone
Data Manager and Assistant Data Manager	Accreditation (organisation)	NAS manual; NAS Data Dictionary; Client Information System; problem Client Records
Clinic staff members	Professional practice (individual, member of team)	Client Record;
Designated Radiologist	Best practice; standard practice Adjusting clinic practice so that maintain accreditation (organisation)	NAS manual; Client Record
Data Manager; Program Manager; Designated Radiologist	Monitoring and reporting outcomes of practice (individual, team) Measuring practice against accreditation standards	Client Record; Client Information System; NAS manual; BSA reporting tools.
Education and recruitment officer	Client participation Accreditation (organisation)	Recruitment Plan; Client Information System – overall participation rate only

Table 4-5 Actors, activity focus and supporting artefacts

Table 4-5 showed that *accreditation* and *practice* were two preoccupations in the setting that were mutually constituted, such that the requirements of accreditation had strong implications for how work activities were designed and conducted; the everyday realities of screening and assessing women for breast cancer had strong implications for the organisation's performance standards compliance.

Thus, the BST work practice context is dominated by an externally imposed system for organisation-level quality assurance and quality improvement that includes "a formal accreditation program" (National Quality Management Review Committee, 2002).

"A **population-based screening program like BreastScreen Australia** must be implemented with **stronger control and guidance** than is customary in health service development. The report of the AHMAC Breast Cancer Screening Evaluation Steering Committee emphasised the need for a **highly integrated, systematic and coordinated quality improvement program**, which includes standardised accreditation processes, evaluation, and national and state-level coordination mechanisms" ... "The focus of the quality improvement program is to ensure that minimum standards are maintained and to pursue excellence by continually developing strategies to review and improve care. The Program strives for continual improvement through **self-review, feedback, acquisition of new knowledge and skills and change in practice**. As part of its overall approach to quality improvement, BreastScreen Australia also **includes a formal accreditation program**." (National Quality Management Review Committee, 2002: 1)

National Accreditation Standards Manual

"Um, the great advantage of having standards is that you have well, more call it **control** in breast screen than in, well in any other medical situation that I know. There's over control, far too much of it. Um, but it's like everything else if you have far too much you get just enough."

Interview transcript, Clinician

The NAS is very expensive and arduous on staff, but necessary: prompts improvements and "keeps people from going feral".

Field Notes, Data Manager comment

Role of the NAS

The Program Manager believes that: 1) the population health model for health service is incompatible with the acute diagnostic model where the focus is on the individual. In population health you care for the individual in the context of "we need them in the door to deliver the population health benefit" but the focus is on the wider population, and 2) the NAS drives the BST program.

She "lives with the NAS everyday" and "cracks the whip" because at the level of people doing their job: they are following NAS defined policies and procedures but they do not think about the NAS and/or are not aware of the NAS as the driving force for why they do what they do. She believes she has to drive it because the culture of BST includes people not connecting their work to others; people resisting work and putting energy into complaining when they could just do it.

Researcher memo, post interview Program Manager

This assumption is operationalised in a ubiquitous barrier question applied to every BST decision-making activity involving changes to work practices or client data and information support: "*Will the decision outcome comply with the NAS?*" This barrier was applied to the recommendations from a Business Analysis Project in 2005 that was conducted in order to prepare requirements for a new client information system. The recommendations were intended to deliver improved work processes and suggested some changes to the client data collected. The client information system, particularly the database of client records, is essential to the operation and

accreditation of a screening and assessment service and suggestions that did not comply with the NAS were rejected.

Role of the Client Information System

“Unfortunately I think what has not occurred is an understanding of how the **database links directly to our accreditation performance** and there have been a number of things that just haven't been captured because that understanding isn't there. That **this isn't just about something we measure because we want to, but we have to perform against these boundaries** and so that's why there's these requirements. And we have to report against it and no you can't get rid of making appointments and reporting against each examination being done with individual machines because that's a method of measuring the performance of the machine. So, yes, there are a number of issues actually about the grass roots operation that I think have been lost in the overall business case [for the new client information system].”

Interview transcript, Program Manager

The conflicts between data-oriented staff members and clinic-oriented staff members and the breakdowns in coordinating their work outputs are connected to the different methods and requirements for maintaining accreditation (see Table 8-9). Data support staff members are only required to think about measurement of the organisation using the client record data entered onto the client information system: BST measurement is affected by how quickly or accurately client data is entered onto the system and processed. The data managers are concerned with data quality (complete and accurate) and NAS compliance.

“So, for [the data support staff] to do their job, what they need to know is what the operational manual says, not that the NAS says we have to have that because we want to ensure quality and consistency of service, standards and outcomes etcetera, etcetera.”

“... in the data area, their role is to enter bookings and data. How what they do impacts on the clinic, for most of them, does not enter their consciousness. But you would know, if they double book, or if they incorrectly enter data, it has huge impacts on the clinics: their operation, their efficiency, and from a management perspective, it means that the data that we're extracting is dirty. Sometimes we pick it up; sometimes we don't.”

Interview transcript, Program Manager

Clinicians are focused on delivering client/patient-centred care from a clinical perspective. However, they do not always demonstrate commitment to the technical information priorities of accurate and complete client records or the BSA work standards of best practice clinical guidelines. A particular issue for the “Designated” BST clinicians the social context of professional membership and respect for clinical autonomy of fellow members of a specialty. “Collegial persuasion” is difficult to achieve and other social solutions to introducing the NAS into the practice of clinicians (using the counsellors) have emerged.

“For instance, the pathologists have contacted [deleted] pathologists when there’s been a discrepancy between their histological findings and the final open biopsy finding. And the surgeon, [name], who is the designated surgeon, has undoubtedly had contact with his fellow surgeons, um, about things. And there is an awareness, but you certainly can’t- what you can do is- I think the counsellors have an enormous role in this respect- what you can do is follow every case up so that the result is the best available. If at the same time you don’t change the ways of the surgeon, tough, because changing the way people work is often very difficult and not everyone works to quite the same standards. But, if from a BreastScreen point of view you nag like the girls [*counselors*] do, then for an individual BreastScreen patient there are enough layers of safeguards with the safety net finally being the counsellor, that the surgeon or pathologist knows that they’ve made a mistake, not made a mistake, should have done it this way, should have done it that way.”

Interview transcript, Clinician

4.4.3 Concluding Phase two

Interactions between the clinic and data areas in BST thus reflect a situation in which BST is organised to achieve two purposes:

- 1) screen women for breast cancer;
- 2) maintain the organisation’s ‘accredited’ status.

The client record (paper and electronic) is integral to the conduct of both these activities.

The connecting idea or theme for the BST situation is a *nexus between accreditation and practice*. This theme expresses the essence of an organisation-wide problem situation and can be related to symptoms of stress and evidence of conflicting perspectives within the organisation. The conflicts in perspectives centre on the construction of accreditation at individual- and organisation-levels of analysis.

Table 4-6 sets out two dominant and competing constructions of accreditation operating in BST. The constructions are: 1) the way the breast screening organisation accredited as a legitimate and trustworthy health service organisation and 2) the way an individual is accredited as a legitimate and trustworthy health service provider.

Organisation accreditation (artefact construction)	Individual accreditation (social construction)
Fully accorded via a mechanism of measurement by artefact: a client information system that primarily functions as a database for generating reports against the National Accreditation Standards.	Partially accorded via measurement of a clinician’s performance against specific NAS, Primarily accorded via the mechanism of multi-membership: membership of the clinic multidisciplinary team (community of practice) and membership of the professional organisation and group of fellow clinical practitioners (network of practice).

Table 4-6 Organisation and Individual level accreditation

Clinic staff members are required to think about the needs of the client and fellow staff members and the requirements for membership of their profession: BST measurement is affected by the quality of clinical judgments as recorded on the client

record but a clinician's accreditation is primarily a social construct of participation and identity with fellow professionals. Clinician accreditation comes from membership and multi-membership of communities and networks devoted to developing clinical practices to provide health care services to people; failure to meet a NAS standard does not unilaterally translate to a failure of professional membership, although the NAS has influenced the standards required by the professions.

Drawing on the analysis summarised in Table 4-4, the constructs of *community of practice* (Wenger, 1998) and *network of practice* (Brown & Duguid, 2000) describe the role *membership* and *multi-membership* have in constructing individual accreditation for clinical practice and identify social groupings engaged in learning and developing knowledge and skills (practice). The conflicts between data oriented staff members and clinic oriented staff members and the breakdowns in coordinating their work outputs can be understood as an internal *contradiction* involving the rules mediating organisation accreditation (measurement by artefact) and the rules mediating individual accreditation (membership of a community or network of practice). The construct *network of practice* (Brown & Duguid, 2000) describes inter-related social groupings of clinical specialists engaged in PPT-interactions beyond the BST organisation boundary.

Additional constructs for discussing and describing the *nexus* include *boundary object* and *boundary infrastructure* (Bowker & Star, 1996). *Boundary object* as defined in (Wenger, 1998) describes the properties of the client record artefact functioning as a shared resource for the different purposes of clinical specialists within the screening and assessment clinics context. *Boundary infrastructure* describes BST artefacts with 'canonical' status, naturalised into the practice of multiple communities (Bowker & Star, 1996), not just BST but all accredited screening Services within BSA.

Data reports setting out BST organisation-level performance against the NAS (compliance and explanation reports) also function as *boundary object*, but in a broader sense than within a community of practice (Star & Griesemer, 1989). These reports provide a structure for translating the client data from its use in the local context of the screening and assessment clinics, to use by BST as an organisation monitoring its performance, to use by BST as an organisation reporting its performance to the accrediting organisation. The reports are prepared on a template that ensures BSA can compare BST performance against the NAS requirements and against other Service organisations accredited as members of the national Program.

The *National Accreditation Standards* (2002) and the *Data Dictionary* are used by all accredited Service organisations, standardising the work practice and information system design to provide a coherent and nationally consistent experience for clients in the Program, and as such form a *boundary infrastructure* for the Program members.

4.5 Phase Three: Conceptualising the theme

From Table 4-1:

Research Phase	Structured Data Products	Analysis concluding a phase
Phase Three: <i>conceptualising a theme</i> Activities <ul style="list-style-type: none"> researching key terms; conceptual modelling; testing conceptual models critically reflecting in relation to model development. 	<ol style="list-style-type: none"> Theme description and construct articulation Model one: nexus between accreditation and practice Test → DFD and E-R diagrams for IS artefact Model two: information orientations for an integrated client record; Boundary maintenance construct 	Theme conceptualisation leading to interpretation and discussion (Chapter 5) Conceptual models; meaning of the <i>nexus</i> Interpretation Models interpreted to answer research questions and consider implications for IS design Discussion <ul style="list-style-type: none"> Health Service delivery and accreditation Information integration and work practice standardisation IS research and socio-technical perspectives

Phase three is the outcome of sustained analysis activity over several months. The researcher built on the sociological analysis from phases one and two to develop a conceptual model of BST as a socio-technical system, Model one. Model two is the result of testing the first conceptual model using IS analysis techniques to describe the architecture for the key information support (the client record). Socio-technical and health domain literature was reviewed for insights into the analysis outcomes and deepen the researcher's understanding of the meaning of a *nexus between accreditation and practice*; issues of information integration and work practice standardisation in BST as well as issues in the wider health domain context.

4.5.1 Problem Theme – Key Terms

Phase two analysis identified that the *nexus between accreditation and practice* in BST is characterised by a construction of accreditation in which the processes and structures for organisation-level and individual-level accreditation are fundamentally different (Table 4-6). Organisation-level accreditation is measurement by artefact and individual-level accreditation is a social construction by membership of a professional group.

ACCREDITATION AND PRACTICE

Definitions for the terms 'accreditation' and 'practice' were synthesised from the literature (see Section 2.2.3) including from the websites of associations of health professionals. The definitions were constructed to express the concepts' meaning, independent of context. However, the researcher identified that in the context of health professional work, particularly in BST, both terms varied in meaning, depending on unit of analysis. Table 4-7 is the schema for *accreditation and practice* from analysing the BST data at the level of *individual, community of practice, profession, organisation* and *enterprise*, where 'enterprise' is the collective national

BSA Program aiming to provide Australian women with a breast-screening and assessment health service. (See Table 8-11 for the extended analysis).

‘Accreditation’ can be a social construct, by membership or a technical construct of measurement by an artefact. ‘Practice’ is essentially a social term involving individuals or communities of people working. However, there is a meaning of practice at organisation-level in which managers responsible for quality and standards compliance engage in activities intended to influence individual/team practice and also activities aiming to justify or explain organisation performance. The different meanings for accreditation and practice were built into the problem theme and with the PPT-constructs used in developing Model one.

Construct unit of analysis	Meaning
ACCREDITATION:	Conferred status and authority to act in a domain based on evidence, reputation and /or credit for capacity to act competently and independently
Individual - professional	Accreditation to work by membership of profession. Authority and status to enter into membership of specific community of practice or service organisation. (Artefact proof = credential; social proof = personal reference).
Community of Practice (CoP)	Accreditation by <i>membership</i> of an organisation. Socially constructed by engaging in a practice: developing reputation and trust of other CoP members as use and develop skills and knowledge.
Organisation	<i>Accredited to organise and coordinate PPT- interactions to conduct a given enterprise.</i> Authority and status conferred = objectively measured as competent to best practice quality standard (Artefact proof = NAS data report, accreditation site visit report, letter of accreditation)
Enterprise	<i>Accredited by quantitative measure providing proof that cost-effectively saving lives and that member organisations accredited using objective standards</i> (Artefact proof = aggregated data reports across member service organisations)
PRACTICE:	Customary way of exercising knowledge and skills in an occupation
Individual - Professional	Practice profession within an organisation-defined framework and to professional membership standards. Continuing professional membership mandatory (CPD record). Radiologists' performance feedback on practice for NAS compliance and skills/knowledge improvement. Multi-disciplinary meetings to collaborate and share knowledge
Network of Practice - Professional	Practice as a <i>member</i> of a professional community. Identity includes possession of a repertoire of knowledge and skills and competence to use them (in multi-disciplinary context);
Community of Practice	Socially constructed membership via exercise of personal competencies, skills and knowledge in CoP work. Trust (demonstrate that competent in practice); Responsibility (trusted to act); Authority (natural authority, power to negotiate)
Organisation	Accrediting organisation (BSA) determines framework of standards of best practice for organisation (BST) to operate within. Negotiation of meaning of NAS data reports (explanation of NAS data / justification of practice); Individual representatives on BSA committees (influence organisation directives). NAS compliance mandatory; philosophy of quality improvement framework and population screening ethos

Table 4-7 ‘Accreditation’ and ‘Practice’ schema for different units of analysis

Table 4-8 is analysis in relation to: 1) assumptions about accreditation in the interview and organisation documents data; 2) agreement with those assumptions indicated in interview and documents data and observations and 3) sub-themes related to reasons for assent or dissent to the accreditation-related assumptions underlying the establishment of the BSA Program.

The data indicates that accreditation is linked to social concepts of trust and reputation as well as technical concepts of monitoring and measuring. The organisation-level assumption that accreditation is necessary and the NAS is the appropriate mechanism for ensuring high quality health care service delivery is not completely assented to within the BST context at the level of individual staff members and professionals employed under contract.

	ASSENT/COMMITMENT (implicit or explicit)			
ACCREDITATION ASSUMPTIONS	Organisation level	Individual level	Professional level	Sub themes (assent/ dissent)
Accreditation is necessary for legitimate practice	Yes	Yes	Yes	Trust Reputation Evidence base Membership Monitoring No proof that accreditation improves patient care
To be successful, breast screening must be done according to 'best practice' population screening principles	Yes (Explicit premise of national Program)	Variation (related to role and network/ community of practice membership)	Variation (employed or contracted within the Program or clinician referral)	Patient centred care Patient centred care (individual, diagnostic focus vs population focus) Clinical professional independence / autonomy
Continuous quality improvement is a necessary goal for health care service	Yes (Explicit premise of national Program)	Variation (related to individual motivation and training)	Yes (condition of employment, professional membership)	Continuing professional development Driving the NAS into everyday practice (naturalisation) Unreasonable: staff overload, external constraints
Objective standards and metrics are necessary	Yes ('gold standard' focus)	Yes (qualified-subjective measures important too)	Yes (qualified-subjective measures important too)	Measuring competence Bench marking Too many standards Non-data standards (subjective assessment)
Integration of information and work practice standardisation are necessary	Yes (national Data Dictionary and NAS)	Variation (related to role and network/ community of practice membership)	Yes (as impacts multi-disciplinary practice)	Consistent quality and equity for clients of health care service Tailored patient care Translation problems across contexts

Table 4-8 Accreditation assumptions and assent/commitment for different levels of analysis

CONSTRUCTING ORGANISATION ACCREDITATION AND INFLUENCING PRACTICE

The requirements of BSA for BST to maintain its accreditation within the NAS regulatory framework have both positive and negative effects. Positive effects include introducing ‘best practice’ standards into the everyday practice of individual health professionals. This extends, beyond clinicians working in the context of BST, to clinicians within the specialties of practice that apply to breast cancer diagnosis and treatment (pathology, surgery, radiology).

The Designated Radiologist was a senior clinician who had been involved in the BST Program from its inception. He believed that the NAS was a significant factor in raising the standards of clinical practice in Australia. His observation was that the NAS directly affected clinicians involved in the BSA Program, and also indirectly (by its existence) influenced the practice of clinician members of specialist *networks of practice* using their skills and knowledge outside the BSA context, for example in private practice.

“I think NAS as a whole it wouldn’t be an exaggeration to say that the NAS system in BreastScreen has contributed largely to the very great betterment of women with breast problems in every field, ah, because the very fact it was so closely monitored meant that um, surgeons and other people had to start to think on the same lines. ... it’s not an exaggeration to say the NAS aspect of BreastScreen has affected medicine as a whole, um and it has affected diagnostic mammography immensely. ... there is the awareness that it is being done in a highly regulated fashion by BreastScreen and that therefore they have to come up to scratch with it.”

Interview transcript, clinician

Negative effects observed in BST were related to the interactions between the two different forms of accreditation (Table 4-6). Effects included tensions arising from conflicting perspectives on the implications for clinical practice of the NAS and requirements for BST to allocate human and other resources to manage the tensions. Tensions were between staff members whose role focused on use of client record for accreditation purposes and those whose role focused on delivering a health service for whom the client record provided information support for clinical practice. Evidence of tensions included staff members’ complaints; resistance to changing work practices, “collegial persuasion” by ‘Designated’ clinicians and social alternatives to persuasion where recalcitrant clinicians were unwilling to submit to NAS requirements for data recording or clinical practice.

BOUNDARY MAINTENANCE ACTIVITY AND THE NEXUS

BST employs individual staff members in roles that demarcate them from membership of the BST screening *community of practice*. Their work tasks are at the intersections between organisation-level activities related to maintaining BST’s accreditation and individual-level activities related to the practice of screening women for breast cancer.

This work occurs at the boundary between the clinic area and the data area. It is an activity focused on the client record and was described by the term *boundary*

maintenance by the researcher. From the initial analysis in this phase, the construct was defined as:

Boundary maintenance is the human activity required to create and maintain connections between groups of people working together across and within organisation boundaries (Kelder & Turner, 2007).

For the specific activity of data support staff members entering the data from the paper client record onto the client information system and the Data Manager generating data reports, *boundary maintenance* was described as:

Boundary maintenance is the activity set required within the organisation to convert the information artefacts used for practice ... into information artefacts for organisation accreditation (Kelder, 2007).

This definition was proved incorrect by an IS analysis of the client record and client information system, resulting in modification of Model one (Section 4.5.5) and development of Model two.

Table 4-9 sets out different occurrences of *boundary maintenance* activity that occurs when there is a disjunction between different domains of BST operations. In Table 4-9, the term, 'ΣCR' refers to NAS data reports generated from aggregated client data records for different fields on the client records (CR) held in the digital Client Information System (CIS):

DISJUNCTION BETWEEN BOUNDARIES		BOUNDARY MAINTENANCE
BST level of compliance to NAS <i>Organisation level</i>	BSA requirements for data and practice <i>Enterprise level</i>	<ul style="list-style-type: none"> • Explanation of unmet standards • Proposed changes to practice to increase compliance
NAS requirements for practice <i>Organisation level (ΣCR)</i>	Actual practice <i>Organisation level data implications for individual practice</i>	<ul style="list-style-type: none"> • Feedback to CoP and individual staff members on performance (radiologists only) • Education of clinical professionals on NAS best practice
Meaning of NAS data reports <i>Organisation level (ΣCR)</i>	Meaning of individual CR <i>Individual level (single CR)</i>	<ul style="list-style-type: none"> • Correction of incomplete or inaccurate CR • Explanation of clinic practice for an individual client situation that created unmet standard but kept principle of individual care

Table 4-9 Boundary maintenance and different kinds of disjunctions

INSTITUTIONAL BROKER ROLE AND THE NEXUS

Data reports and 'Explanation of Unmet Standards' reports were constructed by the Data Manager in consultation with the Program Manager and Designated Radiologist. The role of the Designated Radiologist in this activity was to make explicit the meaning of individual client record data for the context of breast screening practice in

the clinics and translate its meaning in relation to organisation performance against the NAS, including any local contextual factors constraining the ability of BST to comply. The role also was to translate the aggregated client record data numbers and make explicit any changes to practice required in the clinics to improve standards compliance.

Accreditation requirements vary within and between *communities of practice* in BST. The formal accreditation requirements (credentials to work, evidence of continuing professional development) varied for different staff members: data and administrative staff members did not have formal requirements to prove ongoing competence to work; accreditation requirements for staff members working in the breast screening *community of practice* were determined by requirements for maintaining membership of their profession (characterised by the researcher as *network of practice*).

In addition to being a member of the clinic *community of practice* and specialist radiologists *network of practice*, the Designated Radiologist has a formally instituted role of *broker*. The role of *institutional broker* carries the responsibility to introduce, and as far as possible enforce the adoption of, 'best practice' standards set out in the NAS to fellow clinicians. The purpose of instituting a brokering role in the clinical context is to ensure the introduction of desired work elements and practices into a community of practice and to encourage the introduction into local networks of practice.

At the organisation-level unit of analysis, ***institutional broker*** is a leadership role, formally instituted within the organisation design for ensuring work practice conforms to accreditation standards of clinical best practice.

- Within the community of practice the role is both leading by example and enforcing standards for practice based on institutional authority.
- Within the network of practice, the role carries no institutional authority and brokering is by education and persuasion.

4.5.2 Conceptual Modelling

SOCIAL SYSTEM ANALYSIS

The analysis using SSM and GTM was a sociological analysis, treating the technical elements as 'things' in the setting used by people, supporting and impacting their work interactions. The sociological analysis indicated the BST situation was structured by a *nexus between accreditation and practice* in which two forms of accreditation operated. Organisation-level accreditation was an artefact construction, by measurement; individual-level accreditation was a social construction, by membership.

Client record data was collected and processed by clinical staff members for clinical judgment purposes. The client record functioned within the screening community of practice as a *boundary object* between members of the multi-disciplinary *community of practice* for coordinating activities and sharing understanding as well as boundary object between clinic-practice and data-accreditation activities.

Workflows and activities that focused on managing the transition of data from the paper client record to the client information system were described as *boundary maintenance* activities. *Boundary maintenance* in relation to the client record was understood as the result of a client record design that did not integrate data from clinical practice with data for organisation accreditation, requiring human intervention to convert it for a different use. This interpretation was tested by an IS analysis (data and process views – see Section 4.5.3) that demonstrated, from a technical system perspective, the client record was in fact fully integrated to provide data to support clinical practice and measure organisation performance for accreditation.

The technical analysis of the client record and its relation to other information artefacts in the setting led to revisiting the analysis of the *boundary maintenance* construct and modifying Model one. An additional conceptual model, Model two, was constructed to synthesise the interpretation of the social system analysis indicating partial integration and the technical system analysis indicating full integration of the client record/client information system to provide data to measure organisation performance for accreditation and data to support clinical practice.

MODELLING RELATIONSHIPS BETWEEN CONSTRUCTS

Figure 4-9 is an example of a preliminary conceptual model to express the impact of the NAS on the system of work practice in the clinic (imposed artefacts and standards) and the dual memberships of clinic staff (working for BST; member of a professional network of practice).

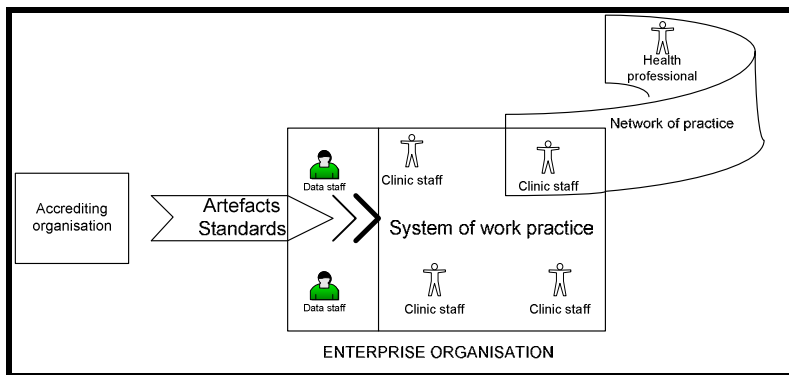


Figure 4-9 Conceptual model: early version

Figure 4-10 is the published version of the model developed from the sociological analysis. It expresses the nexus between accreditation and practice for organisation-level accreditation constructed by artefact and individual accreditation constructed by membership. In this model, *boundary maintenance* was a construct to express the activity of transferring data from clinic practice onto the client information system and the activity of aggregating individual client record data to construct reports indicating the performance compliance of the screening organisation (enterprise organisation) against the standards required by the accrediting organisation.

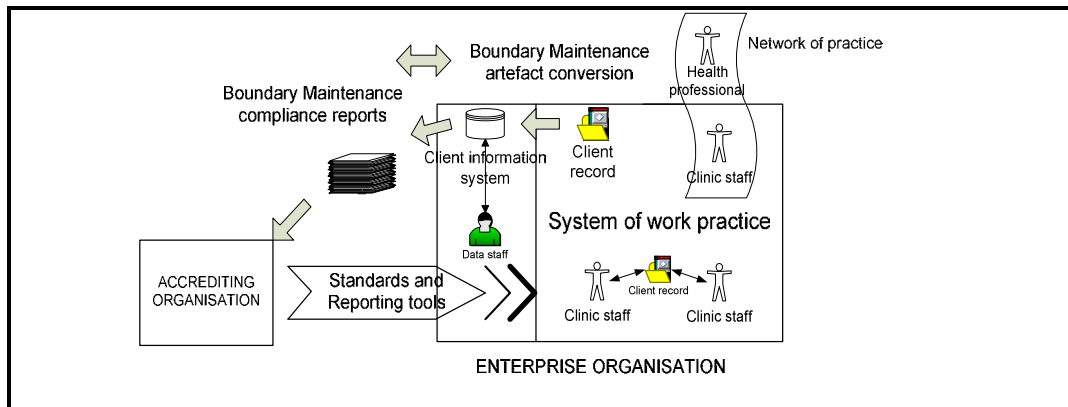


Figure 4-10 Model one: pre IS analysis version (Kelder & Turner, 2007)

Figure 4-10 was developed before the IS analysis of the client record / client information system and other information artefacts forming part of the wider technical information system supporting the BST enterprise.

The final version of Model one (Figure 4-14) incorporates the findings of the IS technical analysis of the client record (see Section 4.5.3) and further sociological analysis (see Section 4.5.4). Model two was constructed as a result of the combined analysis. It represents that the client record was fully integrated for organisation accreditation and supporting clinic practice purposes, but required boundary maintenance to manage changes in meaning across contexts of use. The more nuanced understanding of the activity of *boundary maintenance* and the role of *institutional broker* was incorporated into Model one with the addition of boundary constructs *boundary object* and *boundary infrastructure*.

The two models, deploying constructs and relationships derived from the empirical data and drawing on constructs found in the socio-technical literature, are presented as findings for phase three of this research. Model one has slightly different published versions (Kelder, 2007; Kelder & Turner, 2008), having been adapted during the course of the research analysis.

4.5.3 Testing the Conceptual Model

INFORMATION SYSTEM TECHNICAL ANALYSIS

The context level diagram for BST (Figure 4-11) shows the major data inputs and outputs of the accredited breast screening enterprise viewed as a data processing system. Equivalent entities with elements in Model one are the entities PROFESSIONAL NETWORK (“network of practice”), ACCREDITED BREASTSCREENING SYSTEM (“enterprise organisation” - BST) and BREASTSCREEN AUSTRALIA (“accrediting organisation”).

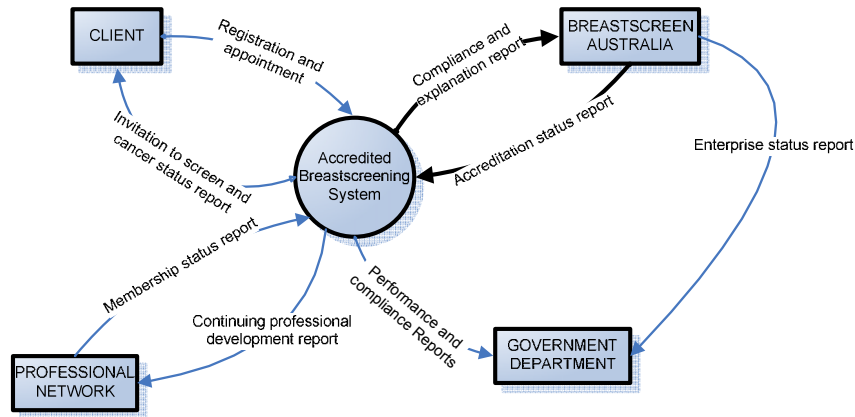


Figure 4-11 Accredited breast-screening system context-level DFD

Screening women for breast cancer involves a range of data collecting and processing activities (Table 4-10). Clinic-based information processing activities by clinicians include recording data from clinical tests and interpreting data, contributing professional specialised knowledge and skills. The clinic context also involves verbal and written communication activity between staff (e.g. multi-disciplinary discussion; clinical notes) and with clients (informing diagnosis; discussing treatment options).

FUNCTION	INFORMATION PROCESSING ACTIVITIES	DATA
Capturing data	Recording clinical data and decisions related to the client, recording equipment data and staff data onto client record	Client record data Equipment data Staff data
Process client data	Transferring data on physical client record to digital client information system, checking data entry for quality	Client information system data <ul style="list-style-type: none"> • Demographic information • Interaction history (date, staff member) • Clinical indicators • Clinician judgment
Monitoring client data	Tracking trends against NAS requirements; meetings to decide actions	Aggregated client record data
Creating reports	Monitoring, compliance and explanation reports; feedback for radiologists	Aggregated client record data
Auditing data	Internal: QA processes External: Accreditation site visit	Physical client record completeness Client Information system algorithms Policy and Procedure compliance Staff work practice compliance

Table 4-10 Functional decomposition BST activities in relation to BSA requirements

Data support staff members manually enter data collected on the client record onto the client information system. Client data recorded on the paper client record includes:

demographic information; interaction history; breast x-ray films; psychosocial information; clinical indicators and clinician judgment – cancer diagnosis. Client data is later processed by the Data Manager at population-level (aggregated client records over specified timeframes) and used to generate organisation performance reports for BSA. Table 4-10 is a functional decomposition of BST information activities that generate data used in BSA reports on organisation performance evaluation.

Nine entity-relation (E-R) diagrams were constructed to provide a data view of BST activities. Eight diagrams set out the content of data collected from individual clients onto a paper client record. Figure 4-12 shows that each data element in the client record mapped to a data element used to calculate organisation performance against the NAS that are linked to quantitative measurements. Thus, the E-R diagrams indicated that the technical system was fully integrated for the purposes of organisation accreditation and information support for clinical practice.

The client information system and the paper client record were conceptually equivalent despite the manual data entry activity. *Client data generated by members of the clinical practice in the course of client service delivery is the data used to measure the organisation performance against the standards specified in the NAS.* It is from the client record data that the Data Manager generates monthly data reports, which are analysed for trends against the NAS, discussed and acted on by the Designated Radiologist, Program Manager and subsequently BST staff members.

The IS analysis indicated that some aggregated client data was available to clinicians as feedback and used as information on individual practice performance. Islands of data existed, but organisation-level accreditation did not depend on their integration or boundary maintenance to convert the data into a form suitable for organisation-level accreditation.

Figure 4-13 is an E-R diagram that identifies: 1) data recorded on the paper client record (and on the client information system) that is used for accrediting the organisation and 2) (circled) data that is not recorded on the paper client record and electronic client information system but is required to be collected for accrediting the organisation and checked during an accreditation site visit.

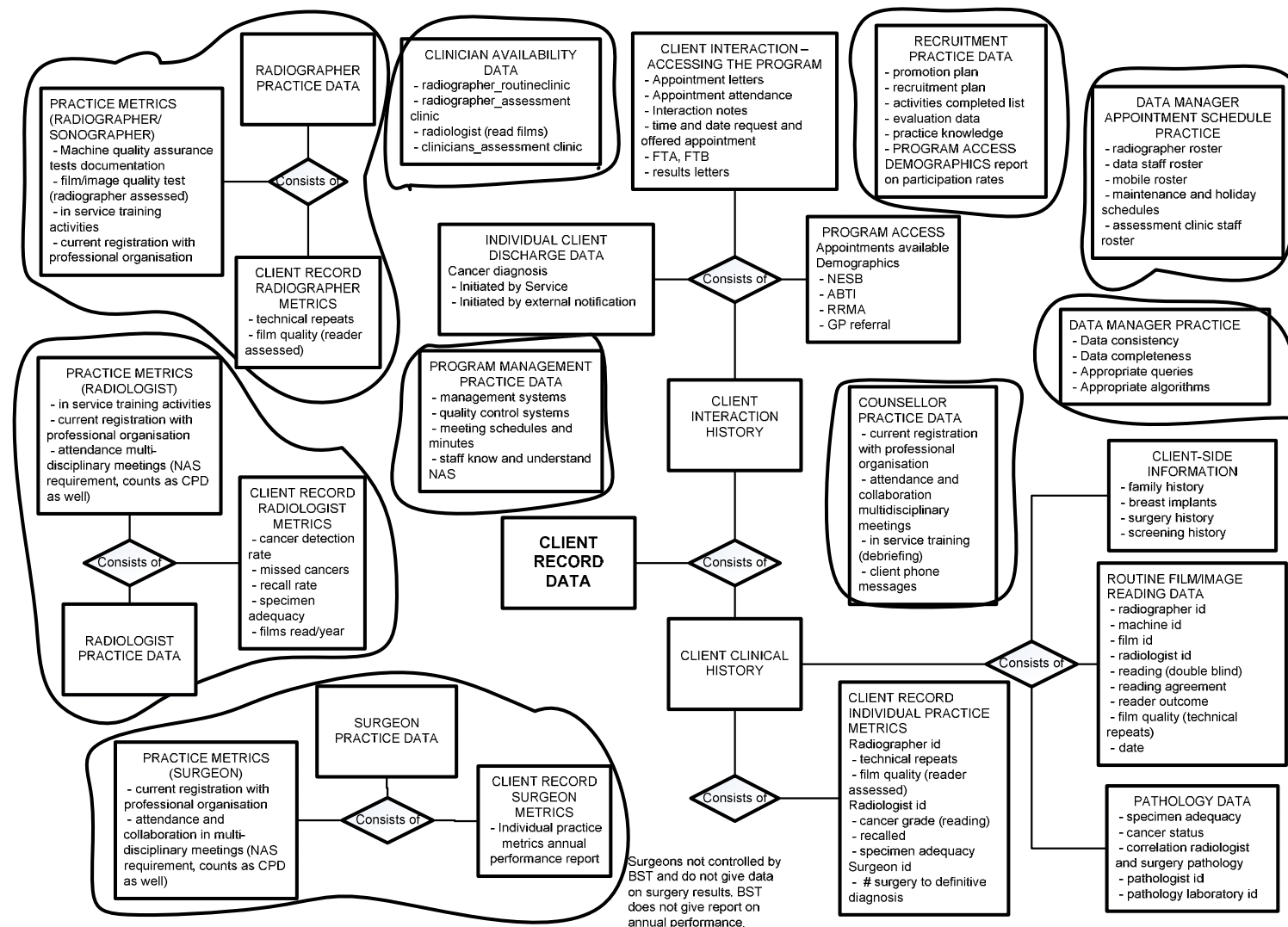


Figure 4-13 Data Collection Requirements for Accreditation

In Figure 4-13 the circled entities represented practice data that was *not* on the client record but was *checked* during accreditation site visit. These are summarised in Table 4-11.

DATA FOR ACCREDITATION - required for NAS not on client record	DATA SUPPORTING PRACTICE - not used for NAS and not on client record
<ul style="list-style-type: none"> • Accreditation of professional clinical staff • Continuing Professional Development (CPD) • Mammogram machine calibration and checking record • Protocols for and evidence that practice e.g. infection control and waste disposal • Multi-disciplinary meetings attendance • Customer survey • Recruitment plan • Evaluation of recruitment and education activities 	<ul style="list-style-type: none"> • Staff rosters and leave • Mobile bus maintenance schedule • Clinical equipment maintenance schedule • Financial data • Materials on current best practice for education and recruitment and for cancer policy development • Waste disposal • Contact information for interactions with relevant people and organisations

Table 4-11 BST data not on the client record: supporting accreditation and practice

Not all data recorded about a client onto the paper client record is transferred onto the client information system and used to measure performance for organisation accreditation: the physical breast x-ray images and clinical notes are only available from the paper record (the introduction of digital mammography has potential to allow digital breast images to be incorporated into a client information system). Not all data needed for renewing organisation accreditation is recorded on the client record (it is checked during an accreditation site visit). Data is collected that supports the work practices of staff but is not part of the reporting system for organisation-level accreditation (e.g. used to support individual-level accreditation requirements for continuing professional development).

4.5.4 Boundary Maintenance Construct Reconsidered

Boundary maintenance activity in BST is focused on client data. It occurs at the boundary of client data use between the clinic and data area. It also occurs at the boundary of client data use between BST and BSA for organisation performance evaluation. The Designated Radiologist acting as *institutional broker* is the key actor involved in *boundary maintenance* in both use contexts.

Boundary maintenance activity involves collaboration between the Designated Radiologist and different staff members, particularly the Data Manager and Program Manager. This collaboration is focused on negotiating shared understanding and reconciling the meaning of client record data for and across different contexts, in particular the meaning for organisation accreditation and the meaning for an individual's or for a team's practice. The Designated Radiologist is responsible for the clinic staff, aided by the Designated Surgeon and Designated Pathologist. The Data Manager is responsible for data area work performance in terms of its impact on data quality. The Program Manager has overall responsibility for BST's implementation and compliance levels regarding the NAS. *Boundary maintenance* has different objectives depending on the problem being addressed and the boundary that client data/information is crossing.

The boundary between the clinic and data areas involved a change from professional-use orientation of individual-situation client data for diagnosis in the clinic to evidence-orientation using population-level aggregated client data for data managers to monitor and report BST's performance. The inter-organisation boundary between BST and BSA required the population-level performance measurement data to be interpreted and explained in terms of the local BST organisation context. This was especially important for Service organisations like BST operating in a State jurisdiction with a population that is small such that one client with a 'false positive' cancer diagnosis results in failing a NAS.

Table 4-12 sets out different occurrences of *boundary maintenance* in the BST context and the outcomes:

Boundary Maintenance Occurrences	Outcomes
1. The meaning of each NAS standard must be articulated and explained to every member of BST: data staff members and clinic staff members. The implications of each NAS standard are formalised into the policy and procedure manuals governing how each role is to be performed and the measurements to indicate the level of compliance are monitored and acted on. Individual mentoring of clinical staff members and multi-disciplinary team meetings provide a 'no blame' context for learning from failure or problems. The accreditation site visit assesses the understanding and commitment of individual staff members to the NAS.	NATURALISATION OF STANDARDS
2. An ' unmet standard ' outcome of a client information system data report measured against a NAS metric requires translation of its meaning from the clinic context. Boundary maintenance is needed to identify when a failing standard is due to work practices in the data area, the clinic area or ineffective interactions between the two areas. The tight coupling of the client trajectory and client record trajectory means that bottlenecks in the data area may be caused by practices in the clinic area and vice versa. The translation results in a decision on if, what and how to change clinical practice to improve the quality of client service measured by that metric (and reverse a trend of failing a NAS).	WORK PRACTICE REDESIGN: DATA OR CLINIC
3. A client complaint needs to be set in the context of the level of organisation compliance with any NAS standard that is related to the complaint. Boundary maintenance is needed to evaluate the validity of a complaint (some complaints are due to client expectations for individual service that a population health service like BST is not required to meet); to identify desirable changes in work practices and to direct the changes to be made.	POPULATION-LEVEL VS. INDIVIDUAL SITUATION DATA JUDGEMENT
4. (<i>Model two</i>): The meaning of a data element on a client record from an accreditation compliance perspective can differ from the perspective of what was best for the individual client from the perspective of a professional clinician and/or from the perspective of an individual client on what constitutes patient-centred care. Boundary maintenance is necessary to preserve all perspectives, particularly in the context of a failing standard from population-level data where patient-centred care for an individual actually occurred.	PRESERVING MEANING IN CONTEXT

Table 4-12 Boundary maintenance occurrences and outcomes

The sociological data on conflicts and tensions connected to the artefacts functioning as boundary objects in the setting was analysed to determine different meanings of client data in the different contexts of use. Table 4-13 summarises the analysis which indicates that *boundary objects* are used in BST for different purposes, moderated by three information orientations. Table 4-13 is slightly modified from the version in (Kelder & Turner, 2008).

BOUNDARY OBJECT	EVIDENCE ORIENTATION	PROFESSIONAL ORIENTATION	CLIENT DECISION ORIENTATION
Digital client information system	Aggregated client record data used to measure organisation performance. Evidence base for quality of organisation practice relative to standards. Potential contribution to EBM clinical guidelines.	Aggregated data on individual and team performance supplied as feedback to inform decisions on how to improve practice. EBM clinical guidelines add to an individual professional's body of knowledge.	Aggregated client data (interpreted by academic community) provides evidence for benefit of proposed clinical decisions on treatment
Individual Client Record	Discussion with client of situation in relation to evidence base (informed consent).	Adding data for shared information and understanding within multi-disciplinary team.	Discussion with client of situation in relation to clinical diagnosis from data recorded.
National Accreditation Standards manual	Sets out standards for breast screening practice and metrics for meeting standards based on evidence of 'best practice.'	'Designated' broker uses NAS to educate individuals and his professional network on 'best practice' standards.	Information for clients on what can expect of a quality health service (client letters, brochures).
Data Dictionary	Sets out required data elements for collection and algorithms for measuring standards compliance.	Requirements for data onto client record: broker ensures members share understanding of meaning of terms	Data collection requirements of client information system do not always support individual client expectations of health service.

Table 4-13 Information orientations and boundary objects, adapted (Kelder & Turner, 2008)

In addition, reports to BSA are prepared using a template required for use by all accredited Service organisations and sent to BSA. The Data Manager populates reports with information from the client information system; the Designated Radiologist and the Program Manager provides contextual information from the organisation situation (e.g. not enough radiographers constraining ability to meet participation rate NAS). The information is presented in the required format and in order to communicate BST's compliance with the *accrediting organisation* standards (the NAS) and provide explanations and plans for improvement where they are not met. These reports function as *boundary objects* for sharing information between the two organisations and have an *evidence* orientation.

4.5.5 Conceptual Model one: a Nexus Between Accreditation and Practice

Model one represents the implications of the *nexus between accreditation and practice* in the BST setting, including interactions with BSA and *members* of health professional organisations. It shows BST as an accredited breast screening *enterprise*

organisation and the multi-domain information interactions required at organisation-level of BST and from individual staff members of BST. *Membership* in the national BSA Program is predicated on demonstrating an organisation-wide commitment to implementing policies, procedures and measurement tools and activities that guide, facilitate and monitor the screening and assessment service delivery.

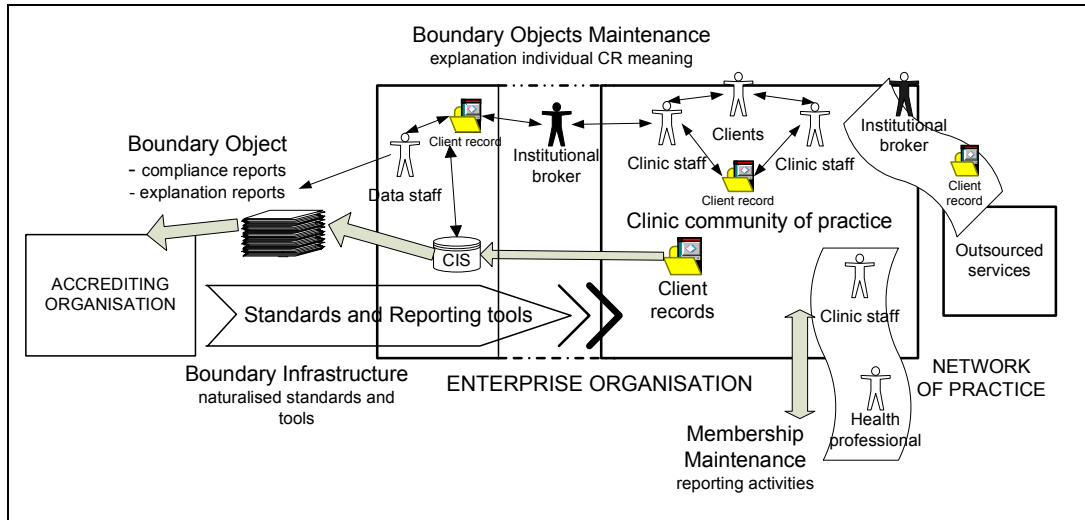


Figure 4-14 Model one: nexus between accreditation and practice

Constructs developed from the empirical data are: *boundary maintenance* and *institutional broker*.

Key constructs from the literature (Table 2-4) for describing the interactions between people, place and things (PPT) are:

- member and multi-membership;
- community of practice;
- broker;
- network of practice;
- boundary object;
- boundary infrastructure;
- naturalisation of standards.

Communities of Practice theory (Wenger, 1998) constructs describe individual-level constructions of accreditation within the context of clinicians who work together as a *community of practice* and are also members of various *networks of practice* (Brown & Duguid, 2000).

The *accrediting organisation* requires quantitative evidence of organisation-level compliance with the NAS standards, derived from the aggregated client record data stored on the digital client IS. The artefacts the *accrediting organisation* produces have the form of *boundary infrastructure* (Bowker & Star, 2000). The NAS, *Data Dictionary* and reporting templates for *enterprise organisations* are translated into Policy and Procedure manuals and designs for a client information system and client

record. The artefacts reflect the *naturalisation* of the standards and tools for measuring performance into each organisation.

Within the clinical *community of practice* that conducts the breast screening service, the client record functions as a *boundary object*. It serves the information needs of the communities connected by mutual use without requiring change of meaning of data categories for each community (Bowker & Star, 2000; Wenger, 1998). Not all members of the clinic *community of practice* use the client record in the same time frame and place. Client records (paper) are transported to and from different clinic rooms as used by different *members*; pathologists do their work in a laboratory and fax the form for their report, which is added to the client record. All members of the multi-disciplinary team use the client record for information about the client and add data generated from their own professional activity.

The Designated Radiologist has a role as *institutional broker* with overall responsibility to ensure that the standards set by the *accrediting organisation* for clinical work practices are met. Assisted by the Designated Pathologist and Surgeon, the *institutional broker* role is to introduce and enforce the adoption of NAS standards into the everyday practice of individual clinical staff members and the multi-disciplinary clinic *community of practice* working in BST as well as the wider professional *networks of practice* whose members also provide a service to BST clients. The desired outcome of this *boundary maintenance* activity is *naturalisation of standards* into everyday practice.

In the wider social configuration (the *networks of practice*), the ‘designated’ clinicians (radiologist, surgeon and pathologist) act as brokers to introduce the skills and knowledge required by the NAS and persuade its adoption into the clinical practice of the medical specialists practicing in Tasmania. The BST service model includes clinical specialists (radiologists, pathologists and surgeons) who work under contract to BST (“*Outsourced Services*”, particularly pathology services) and also surgeons who treat clients of BST. BST does not refer clients with a definitive diagnosis of breast cancer to specific surgeons; that is the responsibility of their General Practitioner. However, BST’s accreditation status is affected by individual surgeon practice and adherence to the NAS ‘best practice’ guidelines.

The primary methods for *brokering* are: 1) providing continuing medical education (professional development) opportunities for clinicians (helping them fulfil their *membership* requirements for their *network of practice*) and 2) “collegial persuasion” – private conversations seeking to persuade individual clinicians to change their practice to align with NAS.

Membership maintenance activities are information interactions independent of the client record. Individual health professionals working within the *enterprise organisation*, BST, belong there as members of a *network of practice* (Brown & Duguid, 2000). Professional staff members must provide evidence of commitment to ongoing professional development to their *network of practice* to maintain their accreditation status and *membership* of a *community of practice* (Wenger, 1998) in BST.

The requirements of membership in *network of practice* can explain the difficulties observed in the relationships of BST's 'designated' clinicians seeking to persuade members of their profession working in other contexts to adopt NAS 'best practice' in their everyday work. For example, the tensions and difficulties felt by the Designated clinicians (Radiologist, Surgeon, Pathologist) in using 'collegial persuasion' as a method for brokering the NAS into the wider group of clinicians working in Tasmania.

Model one represents key elements of the *nexus between accreditation and practice* embedded in the design of the technical elements in the BST information system, particularly the client record (paper and electronic), to comply with the BSA accrediting system. Accreditation of the organisation is primarily constructed by artefact for *measurement* (client record, client information system), while accreditation of individual staff members is primarily socially constructed by *multi-membership* of practices (*community of practice*, *professional network of practice*).

The *institutional broker* role and *boundary maintenance* activities are mechanisms to coordinate and articulate data recorded in the technical information system for organisation accreditation. They also facilitate the social system use of client data for within-practice accreditation (feedback on clinical skills and knowledge; evidence that worthy of respect) and naturalisation of standards into practice.

This model represents the *nexus* as a structure that links and coordinates data and work practices across different activity domains. In particular, it provides constructs for understanding the relationship between organisation-level accreditation (artefact measurement) and individual-level accreditation (membership) and the need for boundary maintenance activities to manage the dissonance between different constructions of accreditation.

4.5.6 Conceptual Model two: Information Orientations In Patient Care Decisions And Evaluation

Model two (Figure 4-15) represents the relations between different information orientations in the client record artefact (paper and electronic). The model combines Mol and Berwick's insights on information in terms of patient care (Berwick, 2002; Mol, 2006) with the *boundary maintenance* construct (see Table 4-12) and the view of the client record as *boundary object* embodying three information orientations (Table 4-14).

The three orientations embedded in the BST client record data are information as: evidence for evaluation (*E-information*), supporting decisions of professional practice (*P-information*) and supporting client choices/decisions in response to their diagnosis (*C-information*). These orientations reflect both different priorities and different contexts of information use. In BST, the dominant orientation is *E-information*, which is founded on its role as a statistically verifiable population-level health intervention Program. The model for funding Service organisations in BSA is linked to their accreditation status: the aggregated client record data from the organization's digital client information system providing evidence that the organisation practice complies with the NAS (National Quality Management Review Committee, 2002).

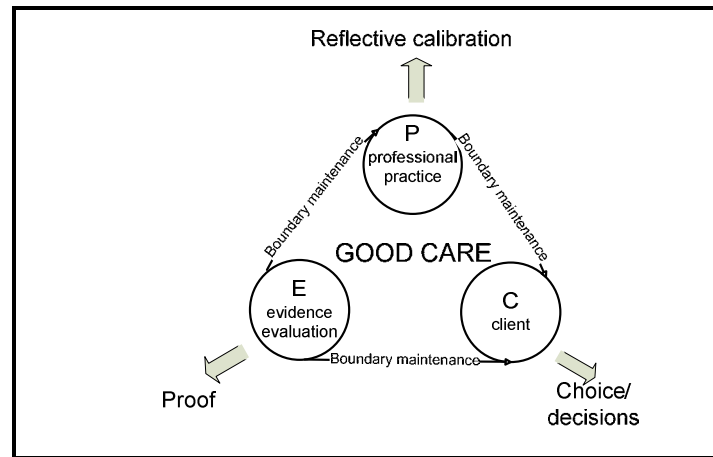


Figure 4-15 Model two: Information Orientations in Client Care Decisions and Evaluation

The client record operates as *boundary object* for data and information sharing between social configurations aligned with different orientations (Table 4-13). These are:

1. the organisations (e.g. performance data reports from BST to BSA);
2. members within the clinic *community of practice* (e.g. outputs of clinical tests done by clinicians from different disciplines);
3. clinician and client (e.g. clinical results discussion); clinic area and data areas (e.g. clinic data used for organisation performance evidence).

BST interactions with clients prioritise collecting and recording data required for accreditation evidence. *C-information* used to calibrate decisions for individual client care may be verbally shared or recorded on the physical client record used by the screening *community of practice*, but is not recorded on the digital client information system used for evaluating the service provided by organisation.

The activities in BST focused on the client record at the boundary between the data area (with its focus on accreditation) and the clinic area (focused on the practice of breast screening and assessment) are between *E-information* and *P-information* orientation. The *institutional broker* role is to justify clinical judgements made or inform clinicians of the requirements of *E-information* data collection and use “collegial persuasion” to encourage them to adopt ‘best practice’ as their own.

The Data Manager and BST Program Manager interact with *institutional brokers* in the *boundary object maintenance* activity of maintaining the distinctions between the meaning of individual client record information and its meaning against the metrics in the NAS. The outcome of this is that the *professional practice-oriented information* utilised in the cognitive activity of screening a woman for breast cancer and the *client-oriented information* in caring for an individual client are kept visible and distinct from the meaning of aggregated client record information that is utilised as *evidence* for accreditation (See Figure 4-14). Model two highlights that each information orientation is important in its own context of use and each contributes to the other orientations to support good care.

The activity of *boundary maintenance* between the three information orientations is a mechanism for facilitating interaction such that the population-level or aggregated client data view of evidence is informed by the context of local professional practice; it also informs that practice. Likewise, the population-level EBM is a source of authoritative knowledge and can support an individual client making decisions in the light of a diagnosis. This can be either mediated by a trained professional interpreting the evidence base for the client's situation or the client accessing it directly.

Table 4-14 sets out the interactions across information orientations that are analysed as occurrences of *boundary maintenance* activity. It shows the relationships between different information orientations and the characteristics of *boundary maintenance* activity to manage differences in meaning embedded in client record data.

DIRECTION	BOUNDARY MAINTENANCE FOCUSED ON THE CLIENT RECORD
P→C	<i>Boundary maintenance</i> by clinical professionals using client record and explaining individual situation data meaning: explaining the meaning of data in an individual client's record from the perspective of providing a definitive breast cancer diagnosis and the implications for which treatment is recommended.
E→P→C C→P→E	<i>Boundary maintenance</i> by clinical professionals explaining client individual situation data in context of evidence-based data and implications for clinical recommendations [clinician initiated; client initiated].
P→E	<i>Boundary maintenance</i> by <i>institutional broker</i> translating and explaining client data from clinic context and implications for meaning of that data used in accrediting organisation context [inter-organisation boundary maintenance].
E→P	<i>Boundary maintenance</i> by <i>institutional broker</i> translating principles and standards for evidence-based medicine (EBM) 'best practice' into a local clinic <i>community of practice</i> [within-practice boundary maintenance]
C→E	<i>Boundary maintenance</i> by <i>client</i> translating and applying knowledge of EBM 'best practice' and knowledge of individual situation data to make decision on treatment.

Table 4-14 Boundary maintenance interactions across information orientations

The management of client data *meaning* is primarily the role of the *institutional broker*. This is especially so in the case of BST interactions with BSA: the institutional broker plays a pivotal role in constructing data reports for evaluation by BSA and responding to challenging questions during an accreditation site visit. The role is to provide expertise in interpreting individual-situation data contributing to failed standards and devising appropriate changes to practice in response. The role is critical in responding to challenges that can pose a threat to BST's accreditation status and therefore eligibility for funding.

Each year, an 'Explanation for Unmet Standards' report is constructed to justify why BST should be accredited despite a failed standard: either explaining how the data can be reasonably interpreted as delivering patient-centred care or setting out changes to practice that can be expected to increase standards compliance. Changes to practice are also the responsibility of the *institutional broker*. He must translate the meaning of a failing standard into implications for how the clinic work practices need to change.

This can involve identifying individuals needing additional mentoring and training; directing or negotiating adjustments team interactions and work flows; organising changes client record design and correcting mistakes in its use.

The activity of organisation performance reporting requires skilled human resources to understand, maintain and translate the different levels of meaning embedded in client record data. These different meanings vary across the contexts of use from individual client record to aggregate client records. The *institutional broker* role and activity of *boundary maintenance* sit between and interpret client record data to facilitate congruent meaning of measurement from ‘within-practice’ context specific activities that generate the data in terms of quality of health service contributing to organisation accreditation. The *institutional broker* role is also ‘within-practice’ and includes the respect due to the demonstrated clinical expertise of the *institutional broker* and the authority of their role as Designated clinician (e.g. Radiologist) in facilitating and establishing naturalisation of BSA standards into the everyday screening and assessment practice.

4.5.7 Critical Reflection: social and technical implications

The BST situation can be thought of as two interacting systems of activity in which the *accreditation-practice nexus* is enacted: social systems and technical systems of activity (see literature review section 2.5 for the basis on which this distinction is made).

Activities related to the *nexus* that are connected the social system of **providing a clinical service** are *practice* based and include: 1) applying judgement to clinical data in the course of delivering a health service to individual clients (as an individual clinician and in discussion with the multi-disciplinary team); 2) verbally communicating the meaning of data to fellow team members and client/patients and 3) discussing client data judgments against subsequent outcomes as professional development.

The activities related to the social system to **support measuring the organisation for accreditation** are partly *practice-based measurement*: 1) collecting/recording client data; 2) maintaining records of professional development activities (individual responsibility) and 3) discuss and implement work practice changes in response to organisation performance measurement outcomes against standards’ metrics. These activities can conflict with the *membership* priorities of clinical practice.

The activities related to the technical system to **support measuring the organisation for accreditation** occur outside the *practice* context and are done by data staff members, assisted by the *institutional broker*: 1) monitor and assure quality of client record data collection/data entry; 2) query client information system (to generate aggregated client data to compare against NAS metrics) to generate measurement of organisation performance and 3) construct formal reports of compliance and explanation based on the aggregated client data outcomes.

Table 4-15 summarises the analysis of the data from a ‘system’ perspective.

<p style="text-align: center;">'SOCIAL SYSTEM' INSIGHTS</p> <p>The social system has achieved partial integration of data for organisation accreditation and for supporting individual practice;</p> <p>Organisation-level accreditation is an artefact-construction</p> <ul style="list-style-type: none"> a) based on NAS data reports from the CIS and evidence of NAS compliance in organisation policy and procedure documents; b) aligned with discourses promoting evidence-based medicine and population-based health services. <p>Individual-level accreditation is a social-construction</p> <ul style="list-style-type: none"> a) competence in the community of practice is measured by reputation as functioning member and partially (radiologists) by individual performance feedback from the client information system NAS data reports and site visit peer-review; b) aligned with discourses promoting evidence-based medicine for assuring professional accountability and quality of practice and discourses advocating the development of competent professional knowledge and skills by membership and multi-membership (<i>local communities of practice</i> and professional <i>networks of practice</i>).
<p style="text-align: center;">'TECHNICAL SYSTEM' INSIGHTS</p> <p>The technical system indicates full integration of data for organisation accreditation and practice and comprehensive work practice standardisation;</p>
<p style="text-align: center;">'SOCIO-TECHNICAL SYSTEM' INSIGHTS</p> <p>The social system properties include conflicts and stress experienced by clinicians. Tensions are due to dissonance between the outcomes of individual clinical practice that has implications for the measurement of organisation performance for accreditation and outcomes of practice with implications for their membership (identity and participation) in a clinical community of practice and network of practice.</p> <p>The socio-technical system properties include a specific role (institutional broker) and activity (boundary maintenance) to manage the consequences of the different information orientations embedded in an integrated client record.</p>

Table 4-15 Social system and technical system insights

CONCEPTUAL MODELS AND BST AS A SOCIO-TECHNICAL SYSTEM

Combined, Models one and two can be used to describe BST as a socio-technical system that has two physically separated but interdependent social sub-systems (data and clinic)¹⁹. The data and clinic social sub-systems share the overall Program objectives of maintaining standards for organisation-level accreditation and high quality individual client/patient service, but prioritise and operationalise the objectives differently.

The technical information system supporting data and clinic work activity is fully integrated across BST and both social sub-systems use the one technical system to support their different work practices. However, the social system interacting with and stretched over the technical system is only partially integrated. The two social sub-systems have to coordinate the data/information outputs of their activities and make their meanings congruent in order for BST to deliver a high quality health service and maintain the organisation's accreditation to continue operations.

¹⁹ The model does not incorporate administration and recruitment activities as the critical elements of the nexus revolve around client record data and client service clinical practice.

The formal, technical information system supports both the work activities related to organisation accreditation and the clinical practice activities related to the delivery of client/patient care. The social system (of which the information system is an integral part) is required to adjust the work practices of its members to fit the constraints of the formal information requirements of BSA for accreditation.

Boundary maintenance can involve social system activity: translating and explaining data for different orientations (both formally and informally) or making judgments of the equivalence of data used in crossing orientation contexts. The outcome of social system *boundary maintenance* is to keep explicit the different meanings and purposes of data for each specific information orientation.

The key artefact of the technical system is the client record, functioning as a *boundary object* both within-practice and between the service organisation and accrediting organisation at population-level data. The key role in the social system is the *institutional broker* and the enabling activity is *boundary maintenance*. *Boundary maintenance* is a social activity focused on meaning of client data and implications for accreditation (explanation) and practice (changes to enable compliance with accreditation).

The different levels of meaning that are embedded in client record data require skilled human resources to construct a credible report of organisation performance. These resources, particularly the *institutional broker* are employed to understand, maintain and translate the meaning of data across the contexts of individual client record to its contribution to meaning in the aggregate of client records.

This activity is what is meant by *boundary maintenance* between the individual client data meaning in the context of professional clinical judgement and aggregated client data meaning in the context of evidence of performance. Evidence information is oriented toward “proof” and in the BST context is not just organisation performance: it is also the actual and/or potential contribution of the client data to different bodies of knowledge devoted to delivering screening and assessment services for breast cancer, providing evidence for efficacy of clinical procedures and protocols and evidence of the cost-effectiveness of the national Program in saving lives.

Organisation funding is dependent on organisation accreditation and results in a priority of NAS measurements over membership values in clinical practice. Organisation accreditation is based on the data in the client record, supplemented by peer review and audit via a site visit from an accreditation team of recognised experts crossing the range of disciplines employed in the Program. The focus on the client record for accreditation means the *institutional broker* role is critical to the success of organisation-level accreditation. The organisation evaluation component of an accreditation visit also depends on the effectiveness of the *institutional broker* in educating clinical staff members on the NAS and facilitating the naturalisation of standards into the everyday work practices of the clinics as they deliver screening and assessment services.

These insights were synthesised as two findings about the social implications of the *nexus* and two findings about the implications (one technical, one social) of the *nexus* for the client record. From Model one:

Implications of the *nexus*: two forms of accreditation in tension

- Two forms of accreditation are in tension due to the difference between how an organisation is accredited and how an individual is accredited for practice.
- Measurement and membership requirements for accreditation are in tension and have positive and negative social consequences for human actors in BST.

From Model two: the BST client record embodies the principles of information integration; the work practices that generate client data have been standardised across Service organisations in the national Program via the National Accreditation Standards.

Implications of the *nexus*: information orientations in an integrated client record

- Information orientation requirements of data in an integrated client record are in tension due to the difference between aggregated data (context free) and individual data (context specific);
- Specific roles and activity are required to manage different levels of meaning embedded in client record data.

4.6 Summary – Data and Analysis

This chapter presented the data collection and analysis outcomes of a human-centred, three-phase multi-method approach for a setting with wicked properties. The aim was to understand the setting, analyse data from the perspective of a problem theme and develop conceptual models useful for understanding an organisation's information support needs and insights for developing a different technical information system. Table 4-1 is a research artefact that can be used as a guide for the method linked to the analysis outcomes for each phase.

The chapter briefly introduced the research setting, BST, a health service delivery setting with wicked problem characteristics. It then presented each phase of the research process: the activities, tools and techniques, including using the PPT construct as a heuristic device for both data collection and analysis. The problem theme identified in phase two was a *nexus between accreditation and practice*.

The method produced several analysis products that informed the construction of the conceptual models. The tables in particular provide a range of analytic perspectives for the concepts accreditation, practice and boundary maintenance. Two conceptual models that represent the *nexus* were developed and presented; findings from the models were articulated. In the next chapter, the conceptual models are the basis for interpreting the meaning of the *nexus* for the substantive domain.

INTERPRETATION AND DISCUSSION

CHAPTER 5 INTERPRETATION AND DISCUSSION

Chapter four provided a detailed exposition of the structure, processes and techniques for the multi-phase, multi-method research approach to understanding a health service organisation with wicked problem properties. A problem theme, *a nexus between accreditation and practice*, was the lens for analysing the BST setting. The chapter presented the products of the analysis for each phase, culminating in two conceptual models that represented the *nexus*.

CHAPTER FIVE OUTLINE

Section 5.1 outlines the findings and literature related to the research questions for the BST setting that are the focus of interpretation and discussion in Table 5-1.

Section 5.2 interprets the meaning of the *nexus* and the conceptual models.

Section 5.3 interprets the research findings in relation to the substantive research questions.

Section 5.4 discusses the research findings in the broader health context, particularly in relation to technical solutions providing information support for health service organisations.

5.1 Introduction

Table 5-1 summarises the research findings, the research questions and discussion topics considered in this chapter.

<i>What is the role of the information system in the functioning of a breast screening and assessment service in Tasmania and what is its impact?</i>		
Conceptual perspective: <i>findings</i>	Research Questions: <i>understanding</i>	Contextual perspective: <i>related literature</i>
<p><i>Meaning of the Nexus Information System</i></p> <ul style="list-style-type: none"> • two forms of accreditation; • measurement and membership requirements in tension; <p><i>Client Record</i></p> <ul style="list-style-type: none"> • information orientation requirements in tension; <p><i>Roles and Interactions</i></p> <ul style="list-style-type: none"> • specific role and activity required in relation to client record data. 	<ul style="list-style-type: none"> • Role and impact of information system • Role and impact of client record on accrediting health service and on supporting clinician and client decision-making • Information system impact on roles and interactions amongst professionals working in BST 	<p><i>Discussion</i></p> <ul style="list-style-type: none"> • BST and the health system crisis • BST and the health system conflict <p><i>Commentary</i></p> <ul style="list-style-type: none"> • health service delivery and health service accreditation • information integration and work practice standardisation • IS research and socio-technical perspectives

Table 5-1 Research questions in relation to concepts and context of the research findings

This chapter uses the conceptual models in conjunction with other analysis products to interpret the findings and address the research questions. It then discusses the research findings in the context of the health system crisis and conflict. It provides

commentary on significant issues related to the broader context of the literature reviewed in chapter two: 1) health service delivery and health service accreditation; 2) information integration and work practice standardisation and 3) socio-technical perspectives and their use in IS research.

5.2 Interpretation – *Nexus* and Conceptual Models

The conceptual models (Figure 1-1 and Figure 1-2) are the outcome of the analysis in phase three (Section 4.5). They represent BST's situation from the perspective of a problem theme: a *nexus between accreditation and practice*. The *nexus* is a perspective of BST that identifies important aspects of a wicked problem situation faced by the organisation. This section interprets the *nexus* and the conceptual models developed from the analysis. The significance and meaning of the findings in the context of the literature is discussed in Section 5.4 – Discussion.

5.2.1 Meaning of the *Nexus*

The *nexus between accreditation and practice* is a relation embedded in the work practices and information system design of BST. The properties of the *nexus* are rooted in the combination of individual-situation data collection that is used for both individual-level patient centred clinical care and population-level organisation performance evidence. The *nexus* is characterised by tensions between two different forms of accreditation and three different meanings of individual client data. The work practice implications of the *nexus* are the role of *institutional broker* and the activity of *boundary maintenance*.

The *nexus between accreditation and practice* affects the actions and operations of BST activities in different ways. The effects of the *nexus* are highlighted by three foci, or units of analysis, in particular: 1) the client record artefact; 2) the technical information system supporting the clinic and accreditation activities and 3) the socio-technical human activity system comprising BST as an accredited screening and assessment organisation to save women's lives from breast cancer.

Considering the **client record artefact**, conflicts exist between how a clinician uses the client record to record data and what the data staff members require of data entry for accreditation purposes. The technical system output required of the client record is accurate and complete data records that can provide reliable measures of organisation performance. The social system output required of the client record is sufficient and relevant data that can provide the basis for multi-disciplinary collaboration and the endpoint: a definitive cancer diagnosis. The technical focus on data accuracy and completeness can be an irritation and unnecessary time waster for social actors in the clinic; the clinic staff members failure to adhere to technical standards wastes the time of data staff members who have to quality assure the data.

Changing the focus to thinking in terms of a **technical information system** (consisting of the client record, client information system, organisation documents setting out policies, procedures, performance standards etc) – the technical system is fully integrated to support both accreditation and practice activities. That is, *data generated in the course of client service delivery is the data used to measure the organisation performance against specified standards*. The client information system

is also used to provide radiologists with some aggregated client data related to their individual performance, confidentially, as feedback information to facilitate learning and developing practice.

However, widening the focus further still to consider the BST situation as an **organisation-wide socio-technical system** reveals a different integration story, in which the social system within BST works toward two dissonant outcomes: *measurement* of the organisation for accreditation and *membership* of individuals in a multi-disciplinary screening *community of practice*.

The outcomes are mirrored in the different forms of accreditation in the *nexus*: organisation by measurement; individual by membership. They are also mirrored in information orientation requirements in an integrated client record that are in tension due to the difference between aggregated, population-level data (context free) and individual-situation data (context specific). A specific role (*institutional broker*) and a multi-dimensional activity (*boundary maintenance*) are required to manage different levels of meaning embedded in client record data that is designed for information integration to support both organisation accreditation and clinical practice.

5.2.2 Conceptual Models

MODEL ONE: NEXUS BETWEEN ACCREDITATION AND PRACTICE

Conceptual model one: *nexus between accreditation and practice* (Figure 1-1) represents a situation where accreditation of an organisation is constructed as measurement by a data integrating *artefact* while accreditation of individuals is socially constructed by *multi-membership*. This highlights a wicked problem implication of an organisation priority of maintaining its accreditation status and prioritising qualities of activities that are measured. The two forms of accreditation can be dissonant and create tension at the point of delivering patient care, as evidenced by the ongoing conflict in the BST setting between data staff members and clinicians.

In particular, the population-level requirements of BST clinicians' work practice (focused on quantitative measures of performance) are dissonant with the individual clinician *membership* requirement to provide patient-centred health care to individual clients. The problems and tensions connected with radiographers could be interpreted as symptoms pointing to different levels of commitment or assent to accreditation-related assumptions underlying the BSA Program (Table 4-8). The organisation priority in that situation is for radiographers to change their practice to ensure population-level client data provided evidence of performance quality.

Population health care is a paradigm that logically entails optimising efficiency in client processing and focuses on number of clients processed; professional clinical health care for individual clients logically entails providing the time required for treatment on a case by case basis for each client and focuses on what the individual needs.

BST is an evidence-based population-health service that is patient-centred when dealing with individual clients. The role of *institutional broker* and the activity of

boundary maintenance are important mechanisms in managing the implications of dissonance and tension between the two models for quality health service delivery. Client data used for both individual-situation and population-level contexts requires *boundary maintenance* as a mechanism to manage the meaning of client data at the boundaries of different contexts of use (Table 4-9).

MODEL TWO: INFORMATION ORIENTATIONS IN PATIENT CARE DECISIONS AND EVALUATION

In contrast to the sociological analysis indicating partial integration of the client record (with *boundary maintenance* occurring by data support staff members), a technical IS analysis indicated that the artefacts used in BST were fully integrated for supporting clinic practice and organisation accreditation. The research findings indicate that an information system that is fully integrated technically still has disjunctions at the level of meaning and requires human activity to coordinate, explain, align and prioritise meanings.

The *boundary maintenance* activity was not located in the data entry and data report generation work; rather in the translating, interpreting and keeping visible the meaning of individual situation-data generated in the clinics when aggregated to population-level measurements of health service delivery practice.

Thus, Model two: *Information Orientations in Patient Care Decisions and Evaluation* (Figure 1-2) represents the *boundary maintenance* implications of the integrated client record for the *nexus between accreditation and practice* structuring the problem situation in BST. It highlights the tensions between three information orientations required of a client record that is designed to integrate client information for accreditation and supporting individual and multi-disciplinary team clinical practice.

From a technical perspective, the client record is fully integrated to provide data that can be oriented to three different purposes: evidence of organisation performance, professional clinical judgment and client decision-making. However, the three orientations for data integrated in a single client record are not integrated at the level of meaning because there is an inescapable difference between the meanings of population-level, evidence oriented data, and the meaning of data in the context of a specific client receiving a health service. *Boundary maintenance* activity by the *institutional broker* in relation to the client record was primarily interpretation and alignment of meaning across contexts.

The problem situation in BST is linked to the healthcare system conflict between the model of population-level, evidence-based medicine to guide and control clinical practice and the model of clinical judgment that is built up case-by-case into expertise applied to individual client/patients. BST is a case illustrating that combining different models for assuring quality of health care services can have both negative effects of IS/ICT-enabled monitoring on professional clinical autonomy and the positive effects of increased standards of care.

The cultural implications of using integrated information and standardised work practices to quality assure health services constitute a dilemma for organisation design and IS design. The *nexus* for BST uses standardisation and information integration as

a mechanism for controlling breast screening health service organisations that can be measured for cost-effectiveness and performance quality. However, a consequence of evidence-orientation dominance is that information for professional and client use can be distorted or neglected and that boundary maintenance is required to maintain the visibility of all three information orientations.

The dissonance in integration between technical (information systems) and social systems in the *nexus* cannot be eliminated by fully integrated computer-based information support systems and standardised work practices (from a technical perspective). One reason is the inescapable difference between the meaning population-level, evidence-oriented data, and the meaning of data in the context of a specific client receiving a health service.

The ambition for evidence based clinical practice requires the collection of data that is in a form that enables aggregation of multiple instances of practice stripped of local context and can be used to measure outcomes and identify patterns that can be generalised. The information required for individual health service client care includes the evidence base for best practice – but adapted and shaped by the wisdom, experience and skill to make judgments by an educated clinical professional who additionally is able to include client-specific information and communicate client-specific decisions for assessment.

Thus a critical healthcare system conflict is between the technical and social means of accreditation (*measurement* and *membership*) and the social and IS implications of the *accreditation-practice* nexus in any particular health care setting. Bringing into membership (educating and integrating clinical practice for standardised and multi-disciplinary work) is founded on having a mutually accepted basis of scientific evidence that is the basis of professional skills and knowledge of how best to approach delivering a health service.

However clinical practice is based on socialisation into a culture and practice that involves a long process of entering into and demonstrating continued commitment to membership as a competent trustworthy professional. The essence of ‘professionalism’ is the belief that the individual and their professional community has the skills, knowledge and commitment to make good judgments in particular situations based on the accepted body of knowledge of the profession and individual situation (See Section 2.2.3 discussion on accreditation). Such assumptions require information systems oriented to support the health professionals’ judgments on best decision for the individual client and providing an individual client with information for making good decisions.

5.3 Interpretation – Research Questions

This section interprets the findings in relation to the research questions for the substantive domain, BST. The socio-technical analysis identified four findings in relation to the *nexus between accreditation and practice* (Section 4.5.7). It interprets the findings in relation to the role and impact of the information system supporting BST activities; the role and impact of the client record (paper and electronic) and the connection of the *nexus* with tensions, conflicts and stress observed between staff members working at the organisation.

5.3.1 Role and Impact of the Information System (Information Support)

The role and impact of the information system in BST is intimately connected to the *nexus between accreditation and practice* embedded in BST's work practice and information system design. BST work practices are designed to comply with 'best practice' requirements set out in the *National Accreditation Standards* manual (2002) for clinic and data activities. This is particularly so for the clinic work practices which are specified on the basis of clinical research and prioritising principles of EBM and the 'gold standard' of randomised controlled trials. Data work practices are specified in terms of best practice information management principles for ensuring data quality (completeness, accuracy) and correctly applying algorithms specified in the BSA *Data Dictionary* for reporting. Client education and recruitment activity is evaluated subjectively by peer assessment during an accreditation visit.

The role of the BST information system is to provide data collecting and data processing capacity for organisation-level accreditation as well as information support for clinical practice and supporting activities (recruitment, administration, data management). The computer-based client information system is fully integrated to fulfil the clinical practice and organisation accreditation data processing and information support functions. The paper client record used in the clinics is conceptually aligned with the client information system at the level of data collected.

The information support system in BST includes data collection and processing that is not included in the client record (paper or electronic) (Table 4-11) and not supported electronically. Client data relevant to non-clinic activities (e.g. recruiting and education performance) is not readily available from the client information system, which is a source of frustration to staff members who would like the client information system to provide information processing to evaluate their activities even though they are not the subject of NAS quantitative measuring and reporting.

The information system operating within BST is part design and part ongoing situated response to external requirements set by BSA. The mandated information interactions between BSA and BST have been resolved by *boundary object* designs (Bowker & Star, 2000). The *National Accreditation Standards* (2002) manual sets out the minimum requirements for how the organisation conducts all aspects of its service (work practice standards); the *Data Dictionary* controls how BST records and measures its work practice outputs and BSA report templates set out the information required for reporting compliance and for recording explanations for failures to meet standards. These artefacts are also used internally in BST to support their quality improvement activities (Table 4-2).

BSA committees or working group recommendations can result in formal decisions to make changes to elements of the Data Dictionary and the NAS. However changes are rare and can take years of evidence gathering, negotiation and deliberation by experts representing their profession on the committee or working group. The relative 'fossilisation' of the NAS meant that at the time of BST's accreditation site visit: some standards were obsolete; some were acknowledged as impossible to meet and some did not exist. For example, in 2005, BST purchased digital mammography equipment for use in the mobile clinic: the work practices for clinic work were

redesigned and BST policies and procedures formulated for digital mammography without BSA having developed or implemented any NAS.

The NAS dominates BST and is an integral part of the technical system of artefacts that support, enable and constrain the work activities there. (The *Data Dictionary* is also a powerful artefact in the organisation; it embeds the data processing implications of the NAS into the client information system design and its effects on work practices are not visible to most staff members (Star, 1995)). The NAS shapes and structures the organisation view of BST's purpose and values. It prioritises accreditation by measurement as an 'objective' method of assuring quality of service over the social model for quality assurance of membership in a community or network of practice. This priority is built into the information system via the client information system: it is designed to support the clinic practice, but the dominant technological frame is that its purpose is to measure and monitor practice.

The client record and client information system is designed to integrate the information needs for organisation accreditation and clinical practice but the NAS and *Data Dictionary* places limits on client information system design, in particular the data that must be collected and how it is to be processed. The NAS as it is currently formulated does not permit a client information system design that would allow clients to access more than one Service organisation accredited with BSA or enable inter-organisation data sharing for benchmarking purposes.

Some of the *boundary objects* imposed on BST have been naturalised into the organisation and operate as *boundary infrastructure* (Bowker & Star, 2000). The NAS and *Data Dictionary* are boundary objects that have been developed and established by BSA as essential infrastructure for any breast-screening service organisation to be accredited. These artefacts have been *naturalised* into organisation work processes and information systems and have become integral to the way screening and assessment services within the national Program are conducted.

The analysis suggests that the accreditation requirements is part of the BST 'wicked' problem situation when faced with external forces that affect ability to meet a standard. For example, an ageing population is a factor in the problem of not enough radiographers to screen registered clients (who are increasing in number). A number of BSA member organisations, including BST, fail the NAS related to participation rates. The BSA response is to accept the explanation so that organisations do not lose their accreditation status, but as one participant commented, "You have to wonder what the point of having standards is, if you can't meet them."

Another impact of the BST information system is that it broadly enforces and then continues to facilitate a structural arrangement of two forms of accreditation in BST. The naturalisation of EBM ('best practice' standards) is achieved technically in the client record that is used as the measurement artefact for organisation-level accreditation. The social system naturalisation of EBM into everyday expectations of how clinic members conduct their practice is facilitated by education and example by the *institutional brokers*, particularly the Designated Radiologist who has primary responsibility for the quality of clinical work.

The information system for disseminating ‘best practice’ principles into the work practices of clinicians includes non-digital tools for collecting and storing various data that is required to be collected by the NAS but not included in annual compliance and explanation data reports for accreditation (e.g. evidence of staff member professional development). The BST information system also supports the diffusion of EBM into networks of practice (wider professional organisations representing clinical specialties). This is through the role of *institutional broker* that includes collegial persuasion and education (e.g. multi-disciplinary team meetings and education/discussion meetings to support and facilitate the professional development).

The information system design that embeds the *nexus* acts passively to prevent screening organisations from adapting to the realities of workforce shortages, client expectations or taking opportunities to change work practices (e.g. new technologies such as digital mammography).

5.3.2 Role and impact of the client record

The client record has different roles in BST, which can be described using PPT-constructs (Table 4-4). It also has different forms: paper and electronic. The paper client record is the focus of interactions between the clinic area and data area staff members, functioning as a *boundary object*, containing data that meets the information needs of both work area activities (Star & Griesemer, 1989). The role of the client record is defined and controlled by other *boundary objects* that function as *boundary infrastructure* in the BSA Program: the *National Accreditation Standards* manual and the *Data Dictionary*.

CLINIC AREA – SUPPORTING DECISION-MAKING

In the clinic, the paper client record functions as a *boundary object* for sharing data and discussing the implications for a client in the context of multi-disciplinary care. It is a *cognitive artefact* that embodies the culturally acquired knowledge embedded in the paradigm of population health and evidence-based medicine articulated in the NAS. It is a technical mechanism for *naturalising* the NAS into the work practices of the clinic and facilitating a culture that accepts the benefits of regulation and interactions between members the clinic *community of practice*.

The BSA ‘accrediting system’ for quality assuring population-level health service delivery to individual clients includes institutional arrangements for an integrated client record via a *Data Dictionary* and NAS manual. The BSA requirements for client record design means the clinic data is also used for the purpose of measuring and monitoring the quality and value of the breast-screening health service organisation.

The integration requirement for the client record allows the use of client data for three orientations (see Model two, Figure 1-1). It also results in the need for skilled human resources devoted to manage disjunctions in meaning of client record data across the boundaries of individual-situation data and contexts of use to population-level client data and its use as evidence.

The paper client record is the primary artefact supporting clinic work. Staff members record the outcomes of clinical investigations onto a paper client record and use the data to support clinical judgments and decision-making. Relevant parts of the client record (e.g. breast images on x-ray films) are used to scaffold discussions with clients about their diagnosis and communicate the implications for treatment options.

Aggregated client data reports are generated by the client information system for the clinic context. The evidence orientation is specifically using client data as feedback for improving practice and also to prompt learning in the context of *community of practice* or *network of practice* meetings. In the clinic context, a negative population-level metric is usually a prompt to identify and review specific client records for further investigation: to determine their meaning and implications for individual practice or the *community of practice*.

The *institutional broker* uses specific client records as a teaching tool to develop skills and knowledge of members of the clinical networks of practice who have connections with BST. Members of the clinical *networks of practice* attend multi-disciplinary professional development meetings to discuss the specific BST cases; share their understanding; develop their collective knowledge base and prove (by the attendance record) their active involvement as members in their profession.

DATA AREA – SUPPORTING MEASUREMENT AND REPORTING

Although the client record is integrated conceptually, it is not integrated at the level of a technology artefact. Thus, at the conclusion of each clinic, data support staff members must manually transfer client data from the paper record onto the client information system. This data transfer activity is a source of bottlenecks to efficient service delivery and communication regarding clients: clients cannot be notified of results until their data is entered on the client information system which then automatically generates a results letter.

BSA institutional arrangements require BST (and any accredited Service organisation) to have a digital client information system with a database function capable of managing the large volume of client data processing required for accrediting the organisation. Its primary orientation is providing a population-level quantitative evidence base for organisation-level performance, with a limited reporting functionality for specified performance indicators to provide feedback into the clinic context.

The role of the client record in the data area context was its population-level use activities supporting organisation accreditation (see Table 4-2). These included monitoring BST's performance against specific NAS metrics; evaluating the trends in terms of compliance; initiating control actions to mitigate threats to BST's accreditation status and constructing formal reports for BSA to use in determining if BST was delivering breast screening and assessment services to appropriate levels of quality and safety. Control actions affecting the clinic were the responsibility of the *institutional broker*, based on the evidence from population-level data reports generated by the client information system, but re-contextualised by a process of investigating specific client records or individual client or clinician situations.

The client record (paper and electronic) reflects the *nexus between accreditation and practice* established by accreditation requirements for BSA. In particular, the integration of clinic practice data with data used for organisation accreditation has social system and technical (information support) systems implications which impact on the BST organisation, staff members and clients. The impact of the information system (in which the client record is a major artefact) is discussed in the next section.

5.3.3 Information system impact on staff interactions

Not all data that supports accreditation or clinical practice is on the computer-based client information system (Table 4-11). From the perspective of arrangements to provide information support for BST activities, the *information system* includes all artefacts in the setting (e.g. post-it notes and whiteboard messages for temporal information sharing; manuals guiding work practice; organisation documents such as plans, forms, minutes, memos and lists). It also includes social arrangements for information interactions between people (e.g. 'info' meetings, multi-disciplinary meetings, performance reviews, informal conversations).

Information is also embedded in the physical layout of the places in which the BST activities occur. In particular, the location of trolleys containing client records (data area, clinic area) indicates the stage in the clinical pathway for a client; piles of client records on bench awaiting processing by data support staff indicates a bottleneck of data entry onto the client information system and risk of failing NAS time-frames specified for client interactions; piles of client records on the designated radiologist's desk indicates clinicians are not filling in data correctly.

In the BST setting, the client record data is the primary information source for staff activities and as such dominates the interactions between staff members. Because the client record embeds the principles of the NAS, the problematic interactions between staff members mirror problems related to the two forms of accreditation identified in the *nexus between accreditation and practice* that is embedded in the technical requirements for the client information system and the client record.

CLINIC – DATA STAFF MEMBER INTERACTIONS

Many problematic interactions between data and clinic staff occur because of, or are connected to, consequences flowing from: 1) clinic staff members' failure to comply with technical requirements for data record quality; 2) clinicians' (e.g. radiologists and radiographers) resistance to changing some work practices in order to improve organisation performance measures and 3) backlogs in data support staff processing client records data onto the client information system, affecting the timeliness of client service delivery (results letters; next steps in clinical pathway).

Thus, a significant impact of the information system from a social system perspective is a negative impact on social relationships and interactions between data-oriented staff members and clinic-oriented staff members. The tensions appear to arise from differences in how the client record is used as a driver for quality improvement in the data and clinic activity areas.

The researcher proposed that one reason for the tension is the situation of two forms of accreditation for practice, in which individual clinicians' are accredited by membership in a *community of practice* and *network of practice*. The role of *institutional broker* and activity of *boundary maintenance* are part of the BST information system response to the need to translate the meaning of client data across a multi-context use of clinic practice and organisation accreditation.

However, pressures on BST to demonstrate quality performance by computer-enabled measurement was a 'wicked problem' in a context of a health system crisis creating a lack of qualified clinicians to do the work. The BST information system (dominated by the computer-based client information system) could not address the problem of insufficient clinicians; only measure its impact as a failed standard. Thus, a possible reason for the stress effects observed in radiographer staff members is that computer generated measurements as were used as evidence that the clinicians should make changes to their practice rather than evidence that the standard could not be met without additional radiographers.

Critically, a clinician's accreditation to practice is independent of the measurement of their practice via the BST client information system; their professional *membership* requirements thus can be expected have more weight in determining their perspective on the purpose of client data and their use of the client record.

Adopting Bijker's (1987) terminology 'technological frames,' the dissonance between use of the client record *boundary object* is not just about different orientations for using the data: delivering client care or measuring client care. The dissonance between data and clinic frames can also be interpreted as being grounded in different concepts of accreditation and different strategies for assuring quality of health care services: strengthening expertise of clinical professionals and trusting their judgment or providing evidence-based clinical guidelines and making them accountable for following them. A possible interpretation of the resistive responses of radiographers to increase screening rates to reverse a trend of failing the NAS for participation rates is dissonant or incongruent technological frames.

Frame incongruence is also a possible genesis of the negative responses of data staff members to the way clinicians used the client record. The reactions of staff members to each other's use of the client record can be interpreted as arising from different information orientations toward client data recorded on *boundary objects* used to share and transfer data between the data and clinic areas (see Table 4-13).

Data area staff members have a technological frame for the client record/client information system that aligns with population-level data processing needs for measuring performance. Clinic area staff members share a technological frame for the client record as supporting delivering professional clinical care focused on an individual client situation in which the client information system provides some feedback performance data that can be used to improve practice.

Clinicians used the client record as an information-sharing artefact aiding clinical decisions between multi-disciplinary professions (requiring sufficient data records for the purpose of diagnosis). However, measurement of the organisation required accurate and complete client data records and the assistant data manager returned

piles of incomplete or inconsistent files in the office of the Designated Radiologist for checking and completing after each of the two assessment clinics each week.

Monthly data reports generated from the client information system are discussed between the Program Manager, Data Manager and Designated Radiologist. They have the authority to make decisions for action to be taken in the clinic or the data area: changing work practices to improve the measurement outcomes from an organisation accreditation perspective.

Clinical staff members have more power to resist changes than data staff members because of difficulty in attracting clinical staff to the Program. The role of *institutional broker* in this situation is to work with clinicians to ensure compliance (education and persuasion). Some decisions have been resisted in the clinic context on the grounds of being unreasonable or that compliance in order to meet population-level priorities contradicts their professional *membership* ethos of individual care and case-by-case judgements.

Data support staff members do not have a *membership* that translates into independent professional identity and authority to determine individual practice. They work under the direction of the Data Manager and Assistant Data Manager. Data staff members who experience negative consequences in their own work due to clinicians' failing to record client data appropriately, from a data quality perspective, perceive that such clinicians cannot be coerced; they can only be persuaded over time with patience by the Designated Radiologist in his role as *institutional broker*.

INTERACTIONS WITHIN THE SCREENING *COMMUNITY OF PRACTICE*

In the clinic context, the client information system is also used to provide aggregated client data in the form of confidential reports to individual radiologists for key indicators such as cancer detection rates and incorrect diagnoses (false positives or false negatives). In this situation the client record functions in the *community of practice* as a resource for a learning community to enable individual members to develop and improve their practice. The discussions and decisions within the *community of practice* on changing work flows, clinical techniques or other factors that are identified as contributing to a failing NAS are also based on the data reports from the client information system.

Within the multi-disciplinary assessment clinic, the information system supporting interactions between professionals is driven by social communication needs to enable members with different knowledge and skills to collaborate and coordinate to generate a cancer diagnosis. The client record (paper) is a technical artefact that is used in conjunction with the social information system to promote learning – discussing individual client records in multi-disciplinary contexts and discussing performance indicators in reports for radiologists. The quality of radiographers' professional work is an assessment of x-ray film/ image quality. Image quality is rated by radiologists at the point of 'reading' a client's x-ray films to assess evidence for breast cancer.

The clinic *community of practice* functioning within BST has naturalised the NAS into their own policies and procedures manuals, formally articulating the expected

work flows and work standards for each work activity. The NAS manual also specifies expectations for how client data is collected and recorded as outputs of clinical practice (clinical judgments).

Within the research interpretive framework of the *nexus*, and drawing on Communities of Practice theory, the role of the Designated Radiologist within-practice is understood as both *member* of the community of practice (participating in learning skills and knowledge and contributing to developing the screening clinic practice) and *institutional broker*. As *institutional broker* he is given authority and charged with the responsibility to ensure the clinic staff members' practice is not only NAS compliant, but naturalised so that they understand and integrate the standards into their everyday practice. This responsibility results in *naturalisation of standards* and *work practice redesign*. These outcomes are from two of the types of *boundary maintenance* activities listed in Table 4-12.

5.3.4 Summary - Interpretation

The role of the information system in the functioning of the BST is interpreted as both support and stressor on BST staff. The information system (of which the client record and client information system are dominant and critical elements) enables clinic staff members to collect and process client and other relevant data that supports them to use their skills and knowledge in diagnosing women for breast cancer. The information system also enables other staff members (Data Manager, Program Manager and Designated Radiologist in his role of *institutional broker*) to monitor how well the organisation performs against the standards requirements set by the accrediting organisation (BSA); to make decisions to correct or improve clinical practice and evaluate the outcomes of changes. It also provides the evidence base of compliance and explanation reports to the accrediting organisation, which decides the accreditation status of BST on the basis of the reports.

The client record artefact has a special role within the BST information system. It operates as a *boundary object* so that the data collected in the course of interactions with clients, particularly in the clinic context, can be used to measure organisation performance once entered on the client information system.

The information system has a strong impact on the roles and interactions amongst professionals working in BST. Positively, it supports delivering a high quality health service to clients by enabling collaboration, communication and decision-making. Negatively, the conflicts and tensions, primarily between data-oriented and clinic-oriented staff members, appear to be emergent behaviours in response to an organisation priority of the population-level view of the data and measuring organisation performance, enabled by the client information system. The tensions are between information derived from attributing meaning to aggregated client data and an individual situation view of the data informing a professional judgment about a client/patient.

The research findings that there are two forms of accreditation (by *measurement* and by *membership*) operating in the BST context is interpreted as a source of dissonance connected to stress and conflict between staff members. For the purposes of information support for both clinical practice and organisation accreditation – the

analysis of the client record identified that it was fully integrated at the level of data content and standardised work practices (and work flows).

The same client data was attributed meaning in three contexts, each prioritising a different orientation in how it was used:

- the individual client context of informing the client oriented the meaning of the data for her communicating and understanding her cancer status and decisions to be made;
- the clinic *community of practice* (and *network of practice*) context orientation for the meaning of the data was as a product of multi-disciplinary clinical work leading to shared understanding, a definitive diagnosis and treatment recommendations, calibrated to the client's situation;
- the meaning of the aggregated client data was oriented toward performance evaluation of the organisation and providing limited feedback for certain clinicians.

The information system to support accreditation and health service delivery was interpreted as including a role (*institutional broker*) and activity (*boundary maintenance*). The role and activity enable the attributed meaning for client data in a particular context and orientation to be maintained across the different contexts of use. It is particularly important in the case of a conflict of meaning in the clinic (individual situation data) with meaning in the data reports (population-level data). The output of *boundary maintenance* in this situation was 'explanation of unmet standards' report and/or action to change work practices to enable meeting standards. The role of the *institutional broker* was to inform the content of those reports.

5.4 Discussion

The research findings have implications beyond the substantive context of the BST research setting. This section discusses the findings in their broader context – the health system conflict and health system crisis – in which the *nexus between accreditation and practice* is a structure constraining BST in the conduct of its breast-screening enterprise. It also discusses the research findings as they relate to issues identified as important in the literature intersecting health service delivery, socio-technical perspectives on organisation and information support system design.

In particular, comments are made at substantive, methodological and theoretical levels regarding the research findings and:

- health service delivery and health service accreditation;
- information integration and work practice standardisation;
- IS research and socio-technical perspectives.

5.4.1 Health System Crisis: IS/ICT and sustainable health services

A critical component of proposed solutions to the problem of delivering health services sustainably (as the population ages) is the design and implementation of

digital IS/ICT information support for health service settings (Grol, 2001). Also, the data processing capabilities of IS/ICT ensures that any model for assuring quality health care includes integrated IS/ICT functioning to support data collection for monitoring and evaluation purposes as well as providing ‘the right information, in the right place, at the right time’ (*origin unknown*) to health organisations, practitioners and clients/consumers.

At a substantive level, many of the stresses and indications of potentially unsustainable work practices required of staff members can be related to the health system crisis driven by an ageing population. The issue is relevant in the BST context because the organisation target population is the rapidly growing demographic of women aged 50-69 years. The effects are compounded in BST as the Program attracts clinicians towards the end of their careers who wish to work part-time and who are not as physically strong and agile as younger workers. BST fails several standards specified in the NAS simply because of a human resource issue linked with ageing population.

A major bottleneck in meeting the NAS participation rate of 70% of the target client population is radiographer availability, to the extent that the recruitment and education officer is ‘too successful’ and clients ringing for an appointments cannot get one in the timeframes specified by the NAS. This 70% target is a statistical measure that relates to population data and cost-effectiveness of screening programs. BST also has a shortage of radiologists available to read breast x-rays and this causes delays in notifying women of the results of their screen, which also impacts of timeframes for a definitive diagnosis specified in the NAS. The inability to attract sufficient qualified staff members and therefore meet NAS constitutes a wicked problem for BST.

Another problem for BST, from the perspective of data-oriented staff members focused on organisation accreditation, is that the organisation has little control over its clinical staff members. This is partly due to a supply/demand situation that gives negotiating power to, in particular, radiographers and radiologists. Changes to practice by clinicians are mostly achieved by negotiation and persuasion.

The discussions recorded in the BST field notes data over what constituted an appropriate workload for radiographers included issues of physical and mental resilience of radiographers – screening is physically tiring and several BST radiographers had a workplace injury or taken stress leave during the research. Radiographers expressed that they were “not just technicians” and needed time to establish rapport with clients on whom they inflicted pain in order to get a high quality breast x-ray.

The role of information technologies to measure performance can become a tool for managers to exert control over health service workers (Bowker & Star, 2000). Interestingly, the BST client information system was not able to provide data to measure radiographer productivity (even though radiographer productivity directly affects BST’s ability to meet the NAS participation rate). Instead an observation-based time and motion study was conducted as a benchmarking project to identify how long a routine screening appointment should take. This in-house project was a measurement focused on judgment and as such resented and resisted by

radiographers. The staff member responsible for collecting the benchmark data commented, “That made me as popular as a maggot in a butcher’s shop.”

The outcome of the project, that it was not possible to determine a benchmark for a routine screen appointment due to the number of variables involved, indicates that although an IT-enabled measure of radiographer productivity could have provided large amounts of data to provide statistical evidence, it would probably have failed to account for local context factors of radiographer location (distance from film processing dark room) and physical characteristics of the particular clients seen in a clinic that affect time required to complete an appointment (larger clients can require up to twelve films, appointment slots assume the norm of four x-ray films).

This resentment generated by the project supports the understanding that monitoring individuals (gathering evidence to require changes to work practice) is resisted when the changes are perceived as unfair and unreasonable. The observation and field notes data showed that radiographers saw themselves as clinicians, not technicians. The reason for resistance from a radiographer perspective was that the organisation value of maximising participation rates from the target population was not aligned with their professional value of professional clinical service to individual clients.

It is possible to argue that there is inherent technology bias in the computer-based client information system design that prioritised technical requirements for efficiently processing client data and measuring staff member work products over human-centred considerations such as patient-centred care and sustainable work loads (Gasson, 2003). Thus, the client information system at BST prioritises the functions related to large-scale data processing and the data reports highlight negative outcomes at population-level organisation performance; subjective performance qualities like team work and staff satisfaction and motivation are not evaluated except during an accreditation site visit.

The conceptual integration of the digital and paper-based systems (described in Section 4.5.3) is such that the data set collected on the paper client record in the clinics is the data set that is manually transferred onto the digital client information system. In that sense, the paper client record is part of the technical system for data collection and assessing organisation-level and individual-level practice against the NAS, and the client information system is part of the technical system for the same purpose. Although the paper client record functions to support practice at the level of individual clients and the particular staff members who provide the service to a client, it cannot be said to be inherently biased towards the needs of clinicians because its design is constrained by the NAS requirements and the NAS metrics for each data standard are population-level measures.

The BSA Program was established as an Australian Federal government initiative in the early 1990’s. Its funding is linked to compliance to the arrangements for accrediting organisations overseen by BSA. It must comply with 176 standards: some of them impossible to meet, many of them difficult to meet and some not yet defined (in the case of digital mammography). BST also has little power to influence the BSA-controlled model for assuring quality of its health care service. In a context of resource scarcity (particularly radiographers) the explanation for unmet participation rates is consistently “lack of qualified staff”. This is a wicked problem for BST.

One of the unintended effects of standardising the work practice and information system requirements the NAS and *Data Dictionary* appears to be that they have “fossilised.” Yet, the environment in which the BSA Program was designed has changed and a shortage of clinicians for the Program means some standards are not possible to meet. “You have to wonder what the point of having standards is, if you can’t meet them,” is a participant comment that reflects an unintended effect of standards setting, affecting staff members’ commitment to the aspiration of “continuous quality improvement.”

In addition, to be accredited as a member of the BSA Program entails limits on adaptability and flexibility in terms of both work practice and information support arrangements. Standards and a priority on measurement for judgment embedded in the structures and processes place the organisation in a situation in which BST cannot make structural changes: 1) provide information support that better suits its current situation and/or 2) adjust work practices to what is needed because of data collection requirements embedded in the client information system.

The organisation cannot adapt either the data it collected or the way it conducted its work because of assumptions related to structure, process or people built into the technical design of the Program, particularly the client information system artefact. Socio-technical perspectives are applied to understanding some of the outworking of information integration and work practice standardisation evident in BST, discussed below.

INFORMATION INTEGRATION AND WORK PRACTICE STANDARDISATION

Information integration and work practice standardisation are two principles for organisation design that are meant to enable the efficient and effective delivery of health services. The socio-technical literature on the role and impact of IS/ICT in health settings is clear that problems of fragmented health services and lack of information integration are not solved by “purely technical solutions to what are, at base, socio-technical problems” (Hartwood et al., 2003: 241). From an IS design perspective, structured IS/ICT design solutions that close down problem definition of ill-structured problem spaces contribute to failure to support work practices and enable the interactions necessary for the effective conduct of an organisation enterprise (Gasson, 2008).

The information system in BST is more than the digital client information system and its paper/film version client record. Technical elements include the client record and computer client information system; policies, procedure, manuals and the *Data Dictionary*. These elements are relatively stable and construct a shared set of information resources to support interactions between staff members (and their clients). The information flows are structured by the technologies, forming immutable mobiles (Moser & Law, 2006).

However, information interactions between people, particularly clinic professionals are also fluid in the sense described in (Moser & Law, 2006), as mutable mobiles. Social information flows occur via social forms of ad hoc human interaction. Examples in the BST data include: discussion about the significance of a clinical outcome; email/phone calling practices and written notes on scraps of paper / post-it

notes; chats at staff morning tea. Social information flows also occur in contexts that construct more formal social communications (meetings, staff memos, staff performance reviews and multi-disciplinary meetings reviewing client records).

Drawing on Latour and Callon, as (Gasson, 2006), a mediating artefact is an inscription of human interests in which power and influence are transferred or translated between organisational groups (e.g. teams, inter-organisation as BSA and BST) by means of human and non-human actors. In this interpretation, the NAS is a mediating artefact that functions as an immutable mobile. Manuals developed within a screening and assessment organisation are based on the NAS: the NAS is used to prescribe exemplar work practice standards and the NAS manual operates as a boundary object, introducing information and standards into the practice. That is, defining what is meant by 'best practice' constrains the meaning of work for those engaged in the work that practice represents. The translation of best practice descriptions into standard work procedures and everyday practice is supervised and promoted by a professional in the role of *institutional broker*.

Gasson's (2006) genealogical study on boundary spanning IS design draws on (Carlile, 2004) to identify features of an organisation setting in which multiple stakeholders worked together to design a new information system to enable integration of information from various units in the organisation and more effective collaboration and decision-making. Several implications of Gasson's (2006) discussion of designing a boundary-crossing IS and co-design of business processes can be identified for the BST situation. The BST situation is that it is an organisation-level instantiation of a stabilised, national Program design (multi-organisation) that was essentially a boundary crossing set of standardised work practices and information support systems designed in conjunction with each other.

Thus, the process of constructing standards is a process of translations of interests (Carlile, 2004). These interests are embedded in the artefacts used by BST: the NAS manual and the *Data Dictionary* mandated for use by BSA; the clinic and data manuals, the client record and client information system developed by BST to align with them. The *National Accreditation Handbook* (BreastScreen Australia, 2005) makes explicit that the purpose of the BSA artefacts is to define and constrain the set of meanings of work for those involved in the work of screening and assessment. In addition to the explicit meanings embedded in the artefacts of accreditation (which function as *boundary objects* and *boundary infrastructure*), the BSA Program design includes the role of *institutional broker*. This role included the task of actively monitoring both organisation and individual staff members' performance and educating clinic staff members to implement BSA's standards into their everyday practice and tacit knowledge.

5.4.2 Health System Conflict: models for assuring quality health services

There are several discernable impacts on BST that can be attributed to the health system conflict. BST is an organisation delivering a health service with a model that asserts the importance of both evidence-based clinical guidelines for practice and expert clinical judgment for the provision of high quality health care. In that sense it is an arrangement for patient-centred care that intentionally combines evidence-based

medicine (with clinical guidelines and ICT/IT-enabled monitoring) with arrangements that support clinician autonomy, while encouraging professional development activities that utilise practice-generated data to improve skills and knowledge at both *communities of practice* and *network of practice* level.

The conflict embedded in the different methods of assuring quality of care is related to two assumptions that are not always compatible, although attempts have been made to demonstrate complementarities (Editorial, 2006). An assumption that is foundational to evidence based medicine is that standardised data is objective, reliable, and comparable across contexts. An assumption foundational to clinical professional expertise is that the professional is to be trusted as competent to practice and make judgments for the treatment of patient/clients independent of supervision or monitoring (Timmermans & Berg, 2003).

The debate between clinical autonomy and accountability and the different approaches to assuring quality is covered extensively in (Timmermans & Berg, 2003). A key insight is the beneficial impacts for quality improvements occur when focused on the health care system rather than the health care professional. Timmermans and Berg (2003) note the negative impacts on clinicians from a failure to separate “measurement for judgement from measurement for improvement”, including suspicion and “defensive reactions (including the most creative ways of number jostling imaginable)” (p. 205).

This focus on health systems rather than clinician practice derives from understanding that “knowledge is embedded in a practice’s organizational routines, forms, protocols and even working hierarchies, embedding a guideline in the social and material context in which health care professionals function might be a much more fruitful way of getting [clinical] guidelines to work” (p. 204).

The interesting thing about this perspective is that the BST data indicates that the technical artefacts for accrediting screening organisations (NAS manual, *Data Dictionary* translated into the policies and procedure manuals and client record/client information system design) have largely achieved the outcome of naturalising clinical guidelines into everyday clinic practice. The data also indicates that the evidence-based practice instituted in BSA has influenced the wider networks of clinical professionals and generally increased the standard of breast cancer care in the acute setting. In this sense, the technological frame established by BSA at national Program level has solved the problem of women dying unnecessarily of breast cancer quite well.

In BST, the main mechanism for improving clinician’s practice occurred in the social context of *membership* of a *learning community of practice*, and focused on individual-situation data. The population-level client data was relevant for indicating need for improvement in specific areas; but actions for improvement were based on reflection on the significance of individual-situation data in the client record.

In addition, the workload of the *institutional broker* to translate the meaning of client data that is processed for multi-context use is inefficient from the perspective of IT-enabled productivity. The multi-layered activity of *boundary maintenance* is an

example of the work that is required to make even standardised work processes and information flows coordinate to achieve the organisation purposes.

The research analysis indicates that both measurement strategies are in place in the BST context: the information support arrangements in BST revolve on client record data that is used to separate measurement for judgment (of the organisation) and measurement for improvement (of clinical practice). The role of *institutional broker* includes utilising NAS reports on key indicators of radiologist performance in a learning community of practice context that is confidential and blame-free.

Individual clinicians are not identified in organisation-level metrics; their practice data is aggregated into one measure for the organisation. However, despite this separation, the priority of organisation measurement for judgment is so strong that clinicians are held accountable in the social context of BST and under pressure to change practice. Social pressures to change created a stressful work environment and highlighted the technological frames of individuals or professional memberships and the priorities of one model for assuring quality care over another.

Measurement focused on improvement was observed to be an important activity for BST radiologists, who used client data reports on measures of their individual practices to discuss, reflect and make changes to improve quality of care. The radiologists' use of practice data from aggregated client records reflects the goal of the BSA model for quality assurance of the Program: an organisation-level culture of continual quality improvement which uses the BSA accreditation process as one tool (National Quality Management Review Committee, 2002). The accrediting model also aims to provide evidence by measurement that objectively proves clients can have confidence in the Program.

So, considering the insights discussed in (Timmermans & Berg, 2003), it is surprising that the problem symptoms of stress and conflict associated with accreditation requirements were so prevalent in the BST setting. The explanation seems to be that the stress occurred when the data for organisation measurement was used as a tool to enforce changes to practice, rather than provided as data to which clinicians could attribute meaning and respond within the clinic context. The data that caused most stress was the population-level data on participation rates, which related to radiographer productivity, not the quality of their work.

In addition, Timmermans and Berg (2003) comment positively on having a reciprocating principle for standards in health care settings in which clinicians' work practices can be transformed by standards and IS/ICT-enabled measurement but also that clinicians have power to transform the standards by which they are measured. The BST data included participant comments that the National Accreditation Standards were "fossilised", to the extent that some were out of date or not able to be met, and standards for new technologies like digital mammography were not developed in time for use. There was no opportunity at clinic or organisation-level to influence standards. Standards are the responsibility of discipline experts in BSA working groups and committees, applying EBM principles reviewing whatever evidence was available.

INFORMATION SUPPORT AND HEALTH SERVICE ACCREDITATION

It is claimed that advances in information systems technology has made the widespread practice of evidence-based health care possible (Timmermans & Berg, 2003), and at the very least has enabled EBM to be facilitated and widely diffused. Information integration and work practice standardisation are important tools in providing the population-level data that can be used within the EBM model for assuring quality clinical care. Computer-based information systems have potential agency as both change agent and enabler for introducing standardised work flows into health practices and enforcing data definitions that provide data that is usable in multiple contexts and for different purposes.

IS/ICT can provide large scale, efficient data processing capability for the health care delivery context, and is very suitable for population-level data used to measure and then evaluate health service work from both efficiency and quality perspectives. IS/ICT is also useful to provide data collection and processing capability for individual situation data, supporting the problem solving activities of individual clinicians and multi-disciplinary teams of clinicians engaged in care for a patient/client. However, client data that is able to be integrated into large scale, multi-use and multi-context data sets needs to be carefully defined and loss of context is a problem for data integrity and robustness when used for a variety of purposes (Schoorman & Balka, 2009).

In addition, a body of socio-technical research has pointed out the limits of the EBM 'gold standard' of clinical trials that aim to produce best practice clinical guidelines. In particular, Mol's (2006) critique of what constitutes 'good care' in the health context highlights that the orientation of clinical trials is to prove that the care practices they study are good, treating the clinic as a laboratory. But what occurs in the clinical context are a series of interventions for an individual patient during which a skilled clinician takes into account the lived experience of a patient, not just the physical disease they may have, and does "creative calibrating of elements that make up a situation, until they somehow fit – and work. Doctoring requires a sensitivity to sensible compromising" (p. 411). The outcome for both client/patient and clinician is understanding of the meaning of the individual situation to enable decisions that are informed and appropriate to the client/patient (Mol, 2006).

This perspective was the source of understanding the 'Professional' orientation toward client data in Model two, as was Berwick's (2002) thesis that 'information is care', and providing patients/clients and health professionals with the information they need for making good decisions is critical if health care is to be safe.

In BST the clinical guidelines for best practice are naturalised into the practice of every clinician who works there. However, as Mol (2006) emphasised, 'good care' does not come from the evidence supplied by clinical trials regarding therapeutic claims, it comes from 'creative calibrating' by a clinical professional that provides a client/patient with the ability to make well-informed choices that suit their lived experiences and circumstances. This insight was adapted to 'reflective calibration' (to describe the professional orientation toward critical reflection on the evidence base of best practice clinical guidelines applied to an individual case) and incorporated into Model two. The conflicting perspectives and problems identified in the analysis

(Table 4-4) could be interpreted as the outcomes of a situation of competing models for assuring “good care” (Mol, 2006).

Berwick starts with the perspective of sustainability and challenges current understandings of what makes health service as “care”. In particular, he challenges the “illogical commitment to the autonomy of clinical decisions” and argues for instead, “a commitment to excellence – standardization to the best known method – above clinician autonomy as a rule for care” (Berwick, 2002: 46). He also argues that the product of health care is not ‘face-to-face’ meetings with clinicians, but ‘healing relationships’. His solution of encouraging other forms of access to help and healing so that those who need the face-to-face encounter will benefit without consequences of failure to meet the needs of others who can benefit from different kinds of encounters.

The perspectives of Mol (2006) and Berwick (2002) provide insight for the BST context, because it is possible to interpret comments in the *National Accreditation Standards* manual (2002) and Program Manager’s interview that those understandings are built into the organisation design, as a ‘sensible compromise’ (Mol, 2006) between the needs of the masses and the needs of individual clients. The perspectives articulated by Mol and Berwick also prompted a series of reflections by the researcher on data sets that had been abstracted by the process of developing the conceptual models, but could be revisited to provide details that enable a richer understanding of the implications of the models for everyday experience of those in the BST environment.

Well women (no symptoms) have very little face-to-face time with a clinician: an appointment slot for a routine screen is 20 minutes, more for women with disabilities or breast implants, and much of this time is spent alone in the x-ray room while the radiographer processes the film to check its quality. In this context the client record functions as a tool for recording clinical data, including a film that will be interpreted by a radiologist. The radiographer is not allowed to give any indication of outcome to the client: her only interpretive role is to make a judgment on x-ray film quality.

In the routine screen clinic, the radiographers’ role was perceived as, in effect, data generation, not clinical care. Time with the clients was minimised in order to maximise the number of women screened. However, radiographers perceived themselves as clinicians, “not just technicians” (Table 8-9) and resisted plans to reduce the time for appointments to 15 minutes, including going on stress leave and taking holidays. Clients/patients who are recalled for a “further assessment clinic” have a very different experience. They have a personal counsellor assigned to them and a whole day of clinical tests and discussions with clinicians and the counsellor on what it means for them. In this context the client record functions as a tool to aid shared understanding, with the client included as participant decision maker (Wales et al., 2002).

Mol (2006) provides a perspective on the role of EBM that prioritises clinical autonomy and advocates health research to focus on strengthening local clinical practice. EBM is criticised for its high view of clinical trials as gold standard, best evidence and for failing to provide the kind of information support that is actually needed in a clinical context of helping individual clients, such as supporting recording

and alerting clinicians to client information that affects their motivation and capability to comply with treatment requirements.

Berwick (2002) takes a global view of health service delivery, and wishes to transform the health service delivery system. Berwick argues that providing information and ensuring standardised clinical practice based on EBM, is a key to any quality health care service.

BST is a case of what can happen when both perspectives are incorporated in a *nexus between accreditation and practice*. Positively, clinical practice is strengthened and standards are improved. However, technical integration of data collection and processing provision does not solve the problem of partial or unintegrated social meanings for information in different contexts. Also, BST situation demonstrates that IT-enabled measurement tended to prioritise the population-level quantitative data associated with gold standard definitions of standardised work practices producing measurable outcomes. This prioritisation was reflected both in the attention paid to NAS associated with hard numbers and the limited computer-based information support provided to enable staff members to improve their practice.

5.4.3 IS research and socio-technical perspectives

The research began with a methodological issue, underpinned by ‘human-centred’ values and an assumption that organisation situations are likely to have wicked problem properties that need to be appreciated before effective information systems support can be provided:

Methodological Issue

How do we scientifically study, understand, analyse and develop new information systems for wicked problem domains (especially in health)?

The method presented in this research was a three phase, multi-method, process inquiry approach guided by SSM and drawing on GTM via PPT as a heuristic device (Table 3-1). It demonstrated the value of drawing on socio-technical approaches and perspectives for use in IS research.

At the broad level of method design, the distinction between ‘wicked’ and ‘tame’ problems was a very useful starting point and rationale for adopting a process inquiry approach to the research setting. This was particularly significant in the BST setting because, after more than a decade of service delivery across Australia, the BSA Program appeared to be a very successful ‘taming’ of the wicked problem of how to save women’s from breast cancer and BST demonstrably delivered a high quality health service in Tasmania.

It could be argued that it is inappropriate to enter a research setting expecting problems and the researcher risks introducing bias into the data collection and analysis. However, the literature on process inquiry approaches (Rosenhead & Mingers, 2001) claims that all organisation situations are subject to ‘wicked’ aspects and criticises approaches that fail to accommodate the ill-structured nature of real

world problem situations. Gasson (2006) and Checkland (1999) have successfully used the concept of 'wicked' (or ill-structured) problems as a premise of their particular process inquiry approaches to IS research in organisations.

Thus, the method for this research was based on the following premises:

- Wicked problems are managed not solved, and any problem solution to a wicked problem generally has unexpected, emergent effects;
- IS research and practice has a tendency to close down problem definition to a 'tame' problem suitable for a technology solution (Gasson, 2003) that needs to be addressed to facilitate human-centred approaches;
- As a health service organisation BST is unlikely to be quarantined from wicked problems besetting the health system identified in the literature review.

The preliminary analysis of wicked aspects of the setting (Section 4.1) identified alignment with issues for health service delivery identified in the literature review. As the research inquiry proceeded, the field data contained many 'problem stories' that were documented in SSM rich pictures and later analysed using both IS methods and socio-technical qualitative methods (for example, Table 4-3 and Table 4-4).

From an IS research perspective, the financial and human resource constraints on IS/ICT projects can result in bastardisation of any approaches adopted from qualitative socio-technical literature (Kelder & Turner, 2005a) and equivocality, even scepticism, about their value in delivering user-centred design (Kujala, 2003). However, socio-technical research, particularly from a grounded theoretical approach, provides insights for understanding organised human activity and the way information and knowledge is incorporated into and distributed across the artefacts, physical environment and human actors interacting in a setting. The issue for the use of socio-technical approaches is the problem of translating insights for IS design (Kelder & Turner, 2005a).

This research has demonstrated that the challenges of using qualitative socio-technical techniques and theoretical frameworks in IS research are balanced by the valuable insights that help tease out different aspects of wicked problem situations. Socio-technical perspectives provided a rich source of constructs and different theories for analysing the field data, in line with Strauss and Corbin's (1994) and Gasson's (2004b) experience and expectations.

Three theoretical frameworks were identified as sensitising lenses (Table 2-2). Distributed Cognition Theory, Communities of Practice and Activity Theory had in common a human-centred philosophy and were grounded in data from qualitative techniques, tested in a range of research settings and able to deliver insights on the consequences of IS/ICT for humans (Section 2.1). The different foci of attention (cognition, community and activity) were a function of different units of analysis (Table 2-3) for interactions of configurations of people, place and things.

The synthesis of these socio-technical theoretical frameworks into the PPT-construct was useful as a heuristic device to keep the research method open to different units of analysis, theoretical perspectives on relations and constructs for analysing the data. PPT prompted the researcher to draw on a body of literature that provided a range of

qualitative data collection and analysis techniques. It sensitised the researcher to lenses for analysing the data from a range of perspectives and provided constructs for structuring the data into conceptual models (Table 4-4).

This research adopted Checkland's 'mode 2' SSM, in which SSM is a systematic process of inquiry that aims to conceptualise real world situations and that the resulting models are for discussing a real world situation from a particular perspective, not an objective representation (Checkland & Holwell, 1998). Thus the PPT-construct was used in the context of critical reflection questions to keep data and analysis open.

The PPT-construct is similar to the OAT-construct (interacting elements: 'organisation', 'agents' and 'technology') used as a sense-making tool in Information Systems (Checkland & Holwell, 1998). The value of the PPT-construct over 'OAT' was the breadth of its use as a heuristic device in all three phases of the method. It is useful as a technique for providing comparative alternative analytic lenses to identify further data sources for collection and for structuring data generated by qualitative techniques (Kelder, 2007; Kelder & Turner, 2005b, 2008).

SSM was very important as the conceptual framework to guide the research *process*. It provided a systems framework for conceptualising the purpose and use of PPT for each phase of the method to generate data and analysis outcomes. In this research, the PPT-construct complemented and enriched the use of SSM tools and techniques for understanding a problem situation.

The use of multiple perspectives from PPT-theoretical frameworks was not simple. It was intellectually demanding to keep open to different perspectives on the data and synergies between them. The goal of the method was appreciation of a problem situation in a specific setting rather than a 'distributed cognition' model or a 'communities of practice' view of a particular data set. Aspects of the problem theme, having been identified, could be described and explained in terms of each PPT-framework, but the important point is that they did not identify the BST problem story of a *nexus between accreditation and practice*.

5.5 Summary – Interpretation and Discussion

This chapter had two main parts: interpretation (Section 5.2 and 5.3) and discussion (Section 5.4). The conceptual models were used to analyse the *nexus between accreditation and practice*. In particular, the two conceptual models were analysed for a sociological and technical perspective to understand how the health system conflict embedded in the *nexus* mirrored the wider health system conflict between population-level data for evidence-based medicine and individual-situation data supporting clinical professionals and individual client decision-making, and the associated models for quality assuring health service delivery.

The findings of the research were then interpreted in terms of the substantive research questions on the role and impact of the information system in the functioning of the breast screening and assessment service in Tasmania delivered by BST.

The discussion related the research findings to the research context and commented on significant issues identified from the literature reviewed in chapter two. The health system has wicked problem properties characterised by a crisis of sustainability and a conflict over models for assuring quality. The problems were linked to the influences of an e-health vision for sustainable, evidence-based, patient-centred health service delivery. The discussion drew on socio-technical literature insights on consequences of using IS/ICT as a technical mechanism for embedding principles of information integration and work practice standardisation into organisation and information support design. It also discussed the utility of socio-technical perspectives in IS research.

CONCLUSIONS AND FURTHER WORK

CHAPTER 6 CONCLUSIONS AND FURTHER WORK

Chapter five presented the understanding of the BST situation provided by the three phase, multi-method approach to researching BST as a wicked problem setting. The interpretation of the research findings was followed by a discussion of the role of IS/ICT and the implications in the wider health setting of health service accreditation, information integration and work practice standardisation and the use of socio-technical perspectives in IS research.

This chapter presents the contributions to knowledge made by this research: substantive, methodological and theoretical. It also indicates future directions for the research and possibilities for IS design in the BST/BSA context to address, in the context of shrinking workforce and increasing client base, a wicked problem tension of models for quality assuring health service delivery and the role of IS/ICT; of organisation accreditation by measurement in tension with individual accreditation by membership.

CHAPTER SIX OUTLINE

Section 6.1 is a brief overview of the research context, setting and method.

Section 6.2 is a synopsis of the research findings related to the problem identified for the BST case: the *nexus between organisation accreditation and individual practice*.

Section 6.3 sets out the substantive, methodological and theoretical contributions of this research project. It also comments on the limitations of the research and generalisability of the research findings.

Section 6.4 draws on the BST case and the conceptual models to discuss possible structural transformations to the *nexus between accreditation and practice* by changes to the information support system design. The section includes recommendations arising from the research.

Section 6.5 discusses future research directions arising from this research. The utility of multi-method multi-phase approach, presented in Tables 3-1 and 4-1, needs to be tested for other situations. The conceptual models developed by the application of the method need to be tested in other health settings where a *nexus of accreditation and practice* operates to test the applicability and generalisability of the models.

6.1 Introduction

This research sits within the Information Systems discipline interest in understanding and analysing the role and impact of information support systems (particularly computer-based IS/ICT) in organisations. The objective at the level of method was to address the problem of how to design and implement a research approach that would enable make a scientific contribution to study, understand and analyse IS designs in wicked problem domains, particularly health settings.

The research setting, BST, was a population health service organisation with wicked problem characteristics. Tensions and competing perspectives were connected to the role and impact of IS/ICT in delivering health care services in the context of a health system crisis (ageing population) and health system conflict (different models for assuring quality of care). The objectives for research specific to the BST setting were to understand the role and impact of the information system in the functioning of the breast screening and assessment Service; the role and impact of the client record in accrediting the Service and supporting decision-making by clinicians and clients and the impact of the information system support on roles and interactions amongst the professional staff members.

SSM was the conceptual framework for the research process, informed by GTM socio-technical research approaches and perspectives. The method was a human-centred, three-phase, multi-method approach to studying wicked problems using PPT-construct, derived from the literature, as a heuristic device.

6.2 Findings – Substantive Domain

The information support provision for BST embedded principles of information integration and work practice standardisation into the design of BST and its provisions for information support. More specifically the BST situation combined two models for assuring the quality of a health care service that were integrated in the design of the client record/client information system.

The system analysis of interacting social and technical arrangements making up the *nexus between accreditation and practice* in the BST situation demonstrated that the client record was fully integrated for organisation accreditation and supporting health service delivery in the clinics. The use of a client information system to store and manipulate client data resulted in an artefact construction of accreditation by *measurement* for the BST organisation. This construction aligned well with population-level data processing capabilities of computer-based information systems and an EBM model for quality assured health service delivery.

However, the accreditation by measurement construction aligned only partially with a model for quality assurance that dominated in the clinics. In the clinic context, accreditation for health service delivery practice relied on individual clinicians' *membership* of a *community of practice* or *network of practice*. The social construction of accreditation by *membership* focuses on individual-situation data and relies on social mechanisms for strengthening *members'* clinical practice within the context of patient-focused health service delivery in which *measurement* is used to inform and improve practice.

The client record/client information system provided a technical source of information support for the organisation activity of screening and assessing women for breast cancer. The primary focus of the technical system was *measurement*: measurement for judgment of organisation performance and, to a lesser extent, measurement to inform improvements to clinical practice. Social sources of information support were provided within the clinic *community of practice*, particularly by the role of *institutional broker*.

The information support provided in the BST setting included an *institutional broker* role. This role involved a multi-dimensional activity of *boundary maintenance*. For the BST organisation, *boundary maintenance* required skilled judgement to interpret and translate the meaning of individual-situation data (in a client record) across different orientations associated with use of the client data for different purposes, scales of activity and contexts. This was because failed standards in terms of BST organisation-level performance did not always mean a failure to deliver quality patient-centred care. *Boundary maintenance* reports were populated by sentences that referred to individual client or local situation data/information that mitigated or explained a failed standard.

There are several points to make in answering the research question: What is the role of the information system in the functioning of a breast screening and assessment health service and what is its impact?

The role and impact of the information system in BST is intimately connected to the *nexus between accreditation and practice* embedded in its work practice and information system design. Its role is to support data collection, processing and interpretation requirements that enable the organisation staff members to deliver a screening and assessment health service and the quality of that service to be measured for accreditation.

The *measurement* function of the information system is provided by artefacts, in particular a client information system that has embedded principles of standardised ‘best practice’ work and integrated information that can be used in multiple contexts and for different purposes. The client information system prioritises measurement for judgment, and only provides limited measurement information supporting improving clinical practice.

The principles, standards and metrics for measurement are articulated in the BSA documents (BreastScreen Australia, 2005; National Quality Management Review Committee, 2002) and its *Data Dictionary*. These artefacts are mandated for use by all Service organisations in the BSA Program and the expectation is *naturalisation*, such that the artefacts function as *boundary infrastructure* (Bowker & Star, 2000).

The information support function for clinical practice (delivering the health service) is provided by artefacts (paper client record, policy and procedure manuals) and by social arrangements for information use. The role of *institutional broker* and the activity of *boundary maintenance* are integral to the information support needs of BST to facilitate the model for quality assurance based on strengthening *members* engaged in clinical practice and using measurement information for improvement in the local *community of practice* context.

Information support provisions in BST have had both positive and negative effects. Standards for health care practices have been raised and best practice guidelines naturalised into everyday ways of screening and assessing women for breast cancer. The clinic staff members work together and exhibit the properties of a learning and developing *community of practice* (Wenger, 1998), and use some of the outputs of the IS/ICT as *measurement for improvement* of clinical practices. However, the dominant model for quality assurance in BST is EBM, and measurement for judgment. The

capability of IS/ICT to readily generate and process population-level data that can be used as information of *measurement for judgement* has increased pressure on certain staff members to change their practices in ways that are not always acceptable to their *membership* in clinical *communities* or *networks of practice*.

6.3 Contribution of the Research

This thesis makes contributions to IS research at three levels (substantive, methodological and theoretical), particularly in relation to discourses of IS research in settings involving the delivery of health care services. Limitations of the research are discussed.

6.3.1 Substantive

At a substantive level, the research contributes to understanding the role and impact of the information system (organised information support) provided in a health service organisation, BST. It provides insight into the uses and effects of a computer-based client information system that is designed according to principles of information integration and work practice standardisation within an EBM framework for quality assurance. The client information system is aligned with a paper client record, designed to provide data for EBM measurement but also for use in a clinic to support decision-making between multi-disciplinary team of clinicians and with clients. The model for quality assurance in the clinic focuses on strengthening clinical practice and the focus of measurement outputs of the client information system is its usefulness in identifying opportunities and learning for improvement.

The research provides empirical data demonstrating that information integration and work practice standardisation did not clearly translate to more efficient and effective health service delivery; neither did it automatically deliver sensible and reasonable measurement of its quality. The role of *institutional broker* was resource intensive, expensive (highly qualified clinicians are paid well) and time-consuming. However, it appeared to be necessary to ensure the meaning of any measurement from population-level client data was not unfairly interpreted into a negative judgment on the quality of clinical practice with individual clients. The problems of prioritising population-level data vs. individual situation data for quality assurance is particularly acute in smaller Service organisations such as BST, where the population sample is relatively small and a standard can be failed because of individual circumstances involving one or two clients.

The research also identified for the BST situation (and potentially, for the BSA Program) that there could be unintended effects from an information system design related to changes in the external environment that are outside an organisation's control. Wicked problem situations develop when the environment changes sufficiently to affect an organisation's capacity to continue operating in the same way and yet the technical arrangements for information support (e.g. standards and algorithms embedded in a computer-based client information system) cannot be adjusted. Rigidity in the technical arrangements flows on into stresses and strains on the social arrangements in the setting, particularly if human actors are pressured to keep trying to meet standards they deem unreasonable from a capacity perspective or

as violating the values of their profession (or *community of practice/network of practice*).

Combined, the conceptual models developed from the analysis represent the BST problem situation of *delivering* a health service and *assuring* its quality and effectiveness. They provide a conceptual framework for gaining insight into some of the complexities of health service design and the role and impact of information system in the context of conflicting models for quality assured health service delivery.

The BST case had two forms of accreditation (organisation by measurement and individual by membership) that co-existed and occasionally conflicted. The lens of a *nexus between accreditation and practice* was a useful framework for exploring the social and technical arrangements in the setting for managing the inescapable differences between population-level data and individual-situation data. It also highlighted the different technological frames for the client information system associated with measurement purposes (judgment; improvement).

The findings have particular application for computer-based information system design and organisation work practice design for situations where integration and work practice standardisation is an object. The research illustrates that a fully integrated technical system does not remove the differences inherent in the meaning of population and individual-situation data; it merely provides a structural framework within which human actors operate to manage the consequences. Social arrangements for information support are important to manage the consequences of different information orientations and priorities inherent in the different uses of client data.

6.3.2 Methodological

This research is a response to the challenges of how to conduct human-centred scientific IS research in the real world of ‘wicked’ and ‘ill-structured’ problems. A particular concern was technology-bias within IS that tends to marginalise and/or effectively dismiss the sociological insights from qualitative approaches that could otherwise inform IS design to better support humans in achieving their goals.

The main methodological contribution of this research is Tables 3-1 and 4-1. These tables are artefacts of the research method that provide the conceptual framework and structure for the research process. The researcher’s expectation is that these tables will assist other researchers in structuring wicked problem situations they are investigating and to progress the data collection and analysis more efficiently.

The research demonstrates the utility of a three-phase process inquiry approach using SSM as a conceptual framework (Checkland & Scholes, 1999) in a wicked problem domain. This research demonstrates the individual method and technique decisions made within an SSM framework that builds in critical reflection and is responsive to emergent elements in the research setting. More broadly, it demonstrates how qualitative research methods and socio-technical perspectives from GTM research frameworks can be utilised for IS research.

The research also contributes the ‘PPT-construct’ as a heuristic device. It is useful as a technique for keeping an exploratory quality in the inquiry process especially in

terms of data collection and remaining open to any challenges to the analysis already done throughout each of the phases. The technique of following trajectories of PPT-interactions beyond the immediate focus of attention constantly challenges the researcher's assumptions and lines of analysis: it keeps the method flexible by utilising and critically reflecting on multiple analytic lenses with different units of analysis.

The problem theme identified in phase two, was *a nexus between accreditation and practice*. This problem theme, supported by the distinction between organisation-level and individual-level accreditation (Table 4-6), is a potentially useful lens for examining the information support implications of quality assurance models for health service organisations. Table 4-7 provides a schema for the terms 'accreditation' and 'practice' in a health service setting for different units of analysis that can be used in another setting to identify instances of socially or artefact constructed accreditation and externally imposed or within-practice developed ways of exercising knowledge and skills. Likewise, Table 4-12 sets out the different occurrences and outcomes of the multi-layered construct, *boundary maintenance*. This table can be used in conjunction with Table 4-9 to analyse roles and work activities connected to disjunctions in information integration at boundaries and whether the activity is focused on the data collected independent of context or the meaning of the data in different contexts of use.

From a methodological perspective, a proactive approach to the literature review in phase one, enabled the researcher to identify appropriate frameworks, methods, and techniques for a rich complex social and dynamic setting like the BST health service and develop the PPT-construct as a heuristic device. Critical reflection was an important technique for thinking through the implications of problems identified in the literature in relation to technology bias and translation of qualitative insights into IS discipline approaches to IS/ICT design. These reflections were presented for discussion in conferences and workshops (Kelder & Turner, 2005a, 2005c). Phases two and three of the method adopted a reactive approach to literature review: searching for PPT-constructs and PPT-frameworks to aid understanding and guide data analysis.

The method demonstrates a human-centred process inquiry approach that can mitigate technology bias in IS research. The method of employing a combination of qualitative research methods and systems modelling and analysis techniques, as set out in Table 3-1, ensures: 1) sociological data is built into conceptual models of the domain and 2) the conclusions are tested for disjunctions between conclusions drawing on sociological data and the conclusions from an IS technical representation of the information system (data flows and entity-relations).

6.3.3 Theoretical

At a theoretical level, the research contributes two conceptual models. The research also articulates the constructs *institutional broker* and *boundary maintenance* representing a structural element and interaction for delivering an accredited public health service in the Australian context. These have been discussed extensively in Chapter 5.

The two models can be used to discuss the substantive issues observed in the organisation. The issues of staff members reporting unreasonable levels of stress; inter-team conflicts; the impacts of accreditation requirements and the difficulty of obtaining a replacement client information system that complied with accreditation requirements constitute a 'wicked' problem with structural causes. Model one (Figure 1-1) represents the structural features of a health service organisation designed and operating to comply with an external accrediting system that requires its standards are internalised and naturalised into everyday practice of individuals working to deliver the service. Model two (Figure 1-2) represents the activities across the boundaries of meaning embedded within a client record that is fully integrated to provide information support for professional practice and communication with clients as well as gather evidence of quality of health service delivery by an organisation.

The models provide a framework for describing and explaining the strategies of boundary maintenance and institutional brokering as positively and negatively affecting a health service organisation's ability to deliver a client/patient-focused health service and maintain organisation-level accreditation.

The models demonstrate the lens of *nexus between accreditation and practice* is useful for generating insights and understanding the problem situation of BST. The findings potentially generalise to situations in which a health service organisation must deliver a population-level service and also is required to facilitate cooperation and collaboration between individual clinical staff members in a multi-disciplinary team. In the BST case, work practices are supported by an information system (Checkland & Scholes, 1999) that is technically integrated for measurement but requires human resources, skill and knowledge to bring together the outputs of a social system for organisation-level measurement and a social system for health care to individual clients/patients.

The conceptual models are potentially useful for understanding, explaining and debating the problem situation of a health service organisation whose continuing existence (funding) is subject to meeting national accreditation requirements. This is pertinent in the current health environment in which information integration and work practice standardisation are part of the 'e-health vision' of transformational IS projects and in which accreditation of organisations depends on reliable, comparable data as an evidence base.

RESEARCH LIMITATIONS

Gasson's ten guidelines or principles for using a Grounded Theory approach in IS research were adopted by the researcher to address issues of quality and rigour (Gasson, 2004b). Table 8-1 summarises the principles and how they were applied in this research project. In particular, the researcher noted the injunction to consider the principles holistically and employ them reflectively.

The research is a single case study of a health service organisation, BST. The limitations of the research method are limits of validity and generalisability as set out in 'Principle 9' Gasson (2004b). A substantive theory has been generated that may be generalisable to health service organisations with similar wicked problem characteristics (Section 4.2).

Any judgement on the value of a research project's contribution to knowledge "is made primarily on the basis of whether new or interesting insights are provided and also on the basis of plausibility, credibility, consistency and transferability of the arguments made" (Gregor, 2006: 625). The conceptual models were shown to a number of BST participants for comment and validated from their perspective. The models have potential application in health service delivery contexts where a *nexus between accreditation and practice* is identifiable as an organisation-wide problem theme that has structure and process implications affecting the design of the information system supporting the organisation.

The research methodology was very time consuming for data collection and analysis (and Kujala (2003) indicates that there are rarely opportunities for such extended and deep investigations). This was largely due to the researcher's inexperience: Checkland's principle that SSM is best internalised rather than used prescriptively, and is learned by doing (Checkland & Scholes, 1999) proved true. Tables 3-1 and 4-1 represent the internalisation process for the researcher and subsequent implementations of the method should take less time, particularly in phase three.

For other researchers, using Tables 3-1 and 4-1 should positively reduce the time spent in each phase of the method and give guidance on the analysis products that are likely to deliver insight.

6.4 Changing the *nexus between accreditation and practice*

This section draws on the BST case as represented in the conceptual models to identify and discuss possible structural transformations to the *nexus between accreditation and practice* constructed by the BSA Program design. Possibilities for structural change include changes to the computer-based information system such that:

- *measurement for judgement* and *measurement for improvement* are equally available forms of information to support quality improvement;
- a national client information system serves the national Program and all member organisations have access to its data processing capabilities;
- an electronic client record registers clients to the Program not a Service organisation (currently client records are the property of the State/Territory jurisdiction Service organisation);
- clients can receive screening and/or assessment in any accredited Service organisation location, allowing mobile clients to access services anywhere within the Program, even being screened in one location and assessed in another by a different accredited Service organisation.

The BST client information system does not support the use of client data generated in the clinic as feedback for most of the BST staff members. Yet the example of the radiologists, who do receive data reports on the outputs of their clinical practice, shows the value of feeding measurement data into a context with characteristics of a learning *community of practice*. The community education and recruitment officer was very critical of the inability of the client information system to generate reports that would measure the effectiveness of her activities in a way that she could learn and change her methods and types of education activities.

In addition, the priority of measurement of the organisation did not produce information that was meaningful for radiographers could be used for developing their clinical skills and knowledge. The ability to track their own productivity and the quality of the breast x-rays could conceivably act as a motivating factor for radiographer staff members, in the same way that tracking their cancer detection rates (and being aware of fellow radiologists' performance) motivated radiologists to improve.

Aligned to this suggestion, a reduction in the number of standards used for measuring the organisation would reduce the amount of *boundary maintenance* required to produce 'explanation of unmet standards' reports and free up the *institutional broker* for meaning-oriented *boundary maintenance* activities: work practice redesign and naturalisation of standards (Table 4-12). This includes using population-level client data measurements as information for identifying improvements to practice in the social contexts of *community of practice* and mentoring individual clinicians as well as educating and persuading members of the *networks of practice* to adopt the 'best practice' standards in the NAS as their own.

Removing obsolete or unreasonable standards is another action that would reduce stress on organisations and their staff members. For standards that are consistently failed despite strong effort, it is important to revisit the assumptions underlying the standards and challenge their canonical status. Simplification and minimisation of standards for accreditation does not imply not continuing to measure multiple aspects of clinical care. However the metrics can be used as information to provide feedback to individual staff (without affecting organisation accreditation).

Technical arrangements (including computer-based information systems) to assure quality can have negative effects on those whose work is measured. It is important to manage and nurture the social context of work, particularly of *membership*. Focus on a specification, defining practice and a metric to measure it, does not create commitment and motivation in individuals.

Providing individual clinicians with information support tools that save them effort can have positive effects on their attitude to those tools. For example, a useful feature of a client information system would be to automatically record credentials and professional development activities undertaken by professional staff members. It could be used to generate reports as evidence of continuing professional development and meeting requirements for professional membership stipulated by each *network of practice*. It could also speed up the process of proving the credentials of clinicians who move from one Service organisation to another so they could start work more quickly (currently credentialing is done at Service organisation-level).

A national client information system for the BSA Program is entirely possible at a conceptual level. Each Service organisation already has a client information system based on the BSA *Data Dictionary*; all their work practices are standardised to the NAS. A national client information system would eliminate the silos of information held in each Service organisation client information systems and result in an information system that is client-centred rather than prioritising organisation accreditation.

The consequence of conceptually centralised data definitions with client data stored in silo databases is that clients currently cannot seamlessly access the national BreastScreen Australia Program service from any jurisdiction, or even – for larger states – regional service within a jurisdiction: they must be registered with a particular Service who must securely retain their client record, even after they cease to be a registered client.

Clients move around and the current funding model linking organisation accreditation to the client record limits flexibility from a client perspective (e.g. mobility expectations) and from the Service perspective, constraining its capacity to manage demand for its health service. Removing the requirement for each Service organisation to store and control each individual client record would mean that clients can move geographically from one service jurisdiction to another and have their client data accessible to the new Service provider.

Of course there will likely be problems associated with a national client information system, but they will not be because of centralised data definitions – those problems are already known and managed through, for example, the activities of institutional brokers. Positively, a health service enterprise information system comprising multiple service organisations would eliminate the current situation in which organisation-level reports completed by individual Service organisations must subsequently be aggregated to produce enterprise level reports on the cost-effectiveness of the BSA Program. This would also facilitate organisation benchmarking. It would also be much more cost-effective to develop one system than the current situation of each Service organisation having to develop specifications and call for tender and finding there are no off-the-shelf systems available in the market.

However, bringing together member screening organisation information systems would require a political decision to change the funding model which is currently linked to the accreditation of each organisation based on measurements from client record data. This is politically difficult in Australia due to a State/Federal division of responsibilities that shares funding under fiercely negotiated agreements.

A national client information system would also imply changing some of the standards: for example the NAS that measures time for different elements of the client trajectory and total time for a definitive diagnosis will not work in the same way if clients can be screened in one state and assessed in another.

6.5 Future Research

This research did not begin with a focus on accreditation. However, the outcome of the research was a lens for investigating the relationship between the way people do their work in an organisation setting and the measurement of that work: a *nexus between accreditation and practice*. This nexus highlighted a ‘wicked problem’ for the organisation and the conceptual models and constructs provided a language and framework for understanding important elements and relationships in the setting. The different aspects of roles, activities, processes, and structures in the setting, and importantly from an IS discipline perspective, the role and impact of the information support provisions, particularly the computer-based information system.

This research could be extended in all three areas that a research project contributes to knowledge: substantive, methodological and theoretical.

6.5.1 Substantive

The research project in BST was a single case. There are over forty Service organisations accredited as members of the BSA Program. A research project repeating the methodology in other Service organisations would be useful to assess generalisability of the case to other Service organisations in the Program, particularly if the problems experienced in BST were similar or different; if the *nexus between accreditation and practice* was evident and had similar or different properties; if the conceptual models applied.

The researcher is aware that there are several dimensions of difference between Service organisations including: size of target population; whether full service is provided or clinical services are outsourced; location (urban areas have concentrated population and rural / remote areas have dispersed populations, needing mobile services) and level of accreditation awarded to the Service organisation (4-year, 2-year, 2-year with high priorities, provisional accreditation and dis-accreditation). The *National Accreditation Standards* and the *Data Dictionary*, and the responsibility for meeting standards and managing the client data are common.

Additional case studies covering the range of key differences would provide a range of empirical data that could then be analysed in a meta-case study to identify if the *nexus* had similar or different qualities and effects and what those were. For example, in its decade-long history had operated under three business models: outsourced clinical services; partially outsourced and full-service model. The interview data had interesting commentary from staff members who had worked within all three models. The full-service model in the BST context facilitated the development of a *community of practice* in the clinics that was entirely lacking when clinical services were provided by a private radiology firm. This raises a question:

What factors affect the role and impact of the information system in the functioning of screening and assessment organisations?

What factors affect the quality of screening and assessment services that their computer-based client information system does not support?

How is the role and effectiveness of the 'institutional broker' affected by factors (dimensions of difference) such as models of service delivery and information provision to clinicians for improving their practice?

This research project has implications for current research focused on health service delivery quality and safety. The value of accreditation and whether it is causally linked to high quality health care is an area of research that is being examined theoretically in Australia by a research team at the *Centre for Clinical Governance Research in Health*.²⁰ Braithwaite et al. (2006) noted that the belief that accreditation

²⁰ See http://www.med.unsw.edu.au/medweb.nsf/page/ClinGov_About last accessed 29/01/2009)

was a valid indicator of high quality health service had been validated by very few empirical studies and proposed a research approach to examine the validity, impact and value of accreditation processes in health care. However, the model hypothesising interrelationships between organisational characteristics does not include information support systems and none of the six research objectives in the proposed “prospective, multi-method, multilevel, multi-disciplinary approach” consider the role and impact of the information support arrangements on the quality of clinical practice and health service delivery.

Research questions in relation to the research proposed in (Braithwaite et al., 2006) include:

How is the culture in the organisation shaped and influenced by the information support provided (particularly computer-based information systems)?

What are the relationships between information support arrangements that support measuring the work done in the course of clinical practice and those that support interactions between clinicians and clients associated with high quality care?

In 2007, the Department of Health and Ageing initiated a multi-project evaluation of all aspects of the BSA Program, including the accrediting system²¹. The request for tender (RFT) for evaluating the “accrediting system” (*Review of the BreastScreen Australia Accrediting System*) had five objectives:

1. identify national and **international best practices** for accrediting healthcare services and determine core criteria for a robust accreditation system;
2. **benchmark** the current system for accrediting BreastScreen Australia services against national and international best practices and the determined criteria;
3. identify the **strengths and weaknesses** of the current accreditation system;
4. identify **suitable options**, consistent with current Australian accreditation reforms, for ensuring the safety and ongoing quality improvement of the screening and assessment services provided by the Program;
5. assess whether the current accreditation system meets its aims, through independent review, to strengthen and sustain the quality of service provision, proving it worthy of public confidence.

In the view of the researcher, the outcomes of this doctoral research raises several questions regarding the relationships between models for assuring the quality and efficiency of health service delivery in the BSA Program and the design of the computer-based client information systems to comply with the *National Accreditation Standards Manual* and the *Data Dictionary*. One of the weaknesses of the current accrediting system is the design of information support for accreditation that prioritises State and Territory autonomy (a political structure) and also prioritises population-level data used as *measurement for judgment*.

²¹ This RTF is now closed and the results are currently unavailable. See <https://tenders.gov.au/?event=public.advert.showClosed&AdvertUUID=8A7CF462-0515-EE2F-8309C313BE78743B> last accessed 29/01/2009.

The BST case could be mapped to the outcomes of the BSA evaluation report and any outcomes of the research Program outlined in (Braithwaite et al., 2006).

6.5.2 Methodology Development

A limitation of the research was that the engagement with the substantive setting ceased once the conceptual models had been developed and validated by participants. This was a function of the findings – the nature of the wicked problem situation was articulated, but the organisation had little power to influence significant contributors to the stress: standards that must be met but were not possible to meet for human resource reasons.

The researcher would like to develop the methodology to include an action research expectation such as assumed in SSM (Checkland & Scholes, 1999), in which the researcher as active participant facilitating change and increasing capacity within the organisation to manage ‘wicked problems’.

The researcher will continue to reflect on the actual steps taken during the process of inquiry with a view to identifying problems with the method (particularly in deciding an appropriate level of data collection and analysis to achieve understanding without overburdening participants or the researcher).

6.5.3 Theoretical Development

The conceptual models need to be tested in other situations to determine to extent to which they can generalise to, for example:

- other Service organisations within the BSA Program;
- other health service organisations under an accreditation regime for assuring quality
- information system support arrangements that prioritise different measurement purposes (e.g. measurement as feedback to facilitate improvement of practice).

The models can be developed or added to in order to think about different structural arrangements for information support and possible effects of alternative information support arrangements.

In (Kelder, 2007), the researcher explored the idea of developing a model to express ‘a continuum of integration’ that would enable removal of *boundary maintenance* activity and increase effectiveness of information flows. This line of analysis was temporarily abandoned when the IS analysis of the client record/client information system demonstrated that the client record was fully integrated for the purposes of organisation accreditation and supporting clinical practice. However, there are theoretically other possibilities for transformational IS/ICT design involving the removal of boundary maintenance, which could be fruitful to study further and model.

6.6 Summary – Conclusions and Future Directions

The chapter has presented and discussed the various contributions to knowledge made by this research. Substantively, a contribution is a deeper understanding of the social impacts of the client information system design in the setting, and how the *nexus between accreditation* embedded in a computer-based information system affects social interactions within the organisation and also the ability of BST to adapt to changing circumstances that are outside its control.

Methodologically, the research contributes a detailed example of a process inquiry approach that is human-centred, multi-method and uses SSM as a conceptual framework to guide the researcher through the project as a process of inquiry over three phases. Table 3-1 and Table 4-1 are artefacts of the research that provide a way of structuring scientific research into a wicked problem and that may be reusable in other domains, or be used as a teaching tool to introduce the thought processes required for the method. Other artefacts of the research method, presented in Chapter 4, are also potentially useful for other research projects.

From a theoretical viewpoint, the research has contributed two conceptual models and the constructs *boundary maintenance* and *institutional broker*. Together, the models represent a *nexus between accreditation and practice* that adopts the principles of integrated information from client records and standardised work practices in a health care setting.

For the future, the substantive research findings need to be tested to determine if the single BST case can be generalised and to what extent. The research method needs to be tested in other domains with wicked problem characteristics. The conceptual models can be tested for applicability to other member organisations of BSA, and other health service organisations operating within an accreditation framework.

This research did not extend to proposals for IS design. It will be useful to investigate using the conceptual models to see if they aid developing recommendations for an IS/ICT architecture that addresses the problems inherent in the current organisation design and builds on the advantages of standardised work practices and integrated information without prioritising measurement for judgment over measurement for feedback and improvement.

The outcomes of using this method demonstrate the value of a three phase, process inquiry approach utilising multiple methods. Socio-technical perspectives are useful for understanding wicked problem domains and the PPT-construct keeps the analysis open to a range of insights for understanding the information support provided in the context of health care delivery. Identifying social insights and social methods of measuring quality of performance of relevance to IS design is time consuming but critical to facilitate human-centred uses of information being supported by the design of technical artefacts for health service delivery contexts. IS design to support standardised work processes and embeds non-social, quantitative forms of measuring that work is relatively straightforward. Understanding, modelling and developing IS that reflects social insights is much more complex but critical if the e-health IS are to have a positive impact on the current vision for patient-centred, safe and quality assured, effective and efficient health services into the future.

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CHAPTER 7 REFERENCES

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APPENDICES

CHAPTER 8 APPENDICES

RESEARCH PRINCIPLES FOR GROUNDED THEORY AND IS RESEARCH

Principles for IS qualitative grounded theory research		Application to research process at BST
1	Explicit process of data collection and analysis (sufficient information to link analysis to findings)	Research publications; email correspondence with other researchers; method chapter
2	Audit trail: research journal and all keeping all analysis documents	Research journal (daily entry); Research record (all documents created, naming convention, filing convention)
3	Explicit acknowledgement and integration of influences (literature, prior understanding, serendipitous insights)	"Ideas and Thoughts" folder; literature reviews for publications; literature review chapter
4	Techniques to make the implicit explicit (memos, question constructs, category network diagrams, write out theory justification)	reflective memos; Visual Art Diaries (annotated sketches, diagrams); brainstorming questions
5	Continuous revision of objectives for proposed theory (define and redefine in terms of "I am trying to ... because I believe...")	Exploratory familiarisation and sense-making phase; reflective questions
6	Meet requirements for constant comparison and theoretical saturation in iteration of data collection-data analysis-data selection and inductive reasoning	Three analytic lenses applied to the data; theoretical constructs chosen that fit with the data; new constructs developed to describe data that does not fit existing constructs; testing the models (IS analysis of client record)
7	Justify emerging constructions to friends and critical colleagues	Regular paper submissions and conference attendance; daily coffee with PhD colleagues; PhD seminars; supervision interactions (face-to-face and email)
8	Techniques to encourage and make explicit self-reflexivity (research journal, self-questioning)	Research journal (record of interactions (literature, conference and with individuals); activities (reading, writing, field work, analysis, conference); thoughts (ideas, plans, issues)
9	Understand limits of validity and generalisability for claims making out of the research	One case study – substantive theory generated: conceptual models that may be transferrable; testing sociological analysis with IS technical analysis (process and data relations)
10	Apply the tenets of Grounded Theory freed from unreasonable constraint that the research process will proceed as planned	Iterative approach to data collection, analysis, construct identification, model development; constant interaction with the literature; three broad (overlapping) phases.

Table 8-1 Research application of (Gasson, 2004b) guidelines

RESEARCH RECORD

The research generated a data set of over 230 documents. These documents were filed chronologically and an Excel spreadsheet created to record base-line information (date collected, document description or file name, participants, brief comments). Research data ‘documents’ included organisation documents; field observation notes and reflective memos. An additional spreadsheet column noted any related documents—which could be either analysis of data or data sources that could be compared or contrasted.

Date collected	Document Label	Related Participants	Related Documents	Comments
16-May-05	05_05_16Fieldvisit_BST_office_Name.doc	Policy officer	05_11_08Scenario_XX_community education officer.doc	importance of pink and of being personal in community education
17-May-05	05_05_17Fieldvisit_BST_office_info_meeting_population health.doc	Representative staff members, researcher		Issues: situating BST in population health (importance); accreditation issues, digital mammogram project, networking problems, modification to surgeons room
18-May-05	05_05_18Fieldvisit_BST_office_business analyst on accreditation process.doc	Business process analyst	05_04_27Accreditation meeting_BST office.doc	criticism on accreditation standards, including dodgy statistical methods and practices to ensure meet the standards (for appointment in 28 days); reflection
25-May-05	State Accreditation Committee (SAC) meeting documents	SAC participants, researcher	Quality Improvement Plan, my notes of meeting, ring bound document on SAC	terms of reference describe its role in relation to BST and NQMC; site visit summary for 2001 accreditation; Data summary report for 1/1/2004 to 31/12/2004

Table 8-2 Research Record Excerpt Phase one

Date collected	Document Label	Related Participants	Related Documents	Comments
10-Aug-05	BreastScreen Tasmania - Data Audit Report - June 2005.pdf	Organisation documents; Accreditation visit auditor		Client records and client information system (data elements and algorithms) checked for NAS compliance
10-Aug-05	State Accreditation Committee (SAC) meeting documents	Committee members		post accreditation site visit- minutes of meeting and documents viewed at the meeting
11-Aug-05	05_08_11Fieldvisit_BST_office_radiographer_data staff.doc	Radiographer J, data staff	05_10_26trajectories_feedback loops.doc	Data staff critical of radiographers taking stress leave, forcing them to rebook appointments; radiographer perspective on talking to women while doing screening appointment.
13-Aug-05	Recruitment Plan 2005-2006	Recruitment officer		NAS requirement. Up to date for accreditation visit, not otherwise as opportunities 'come up' or cancellations frequent.
13-Aug-05	Accreditation Site Visit Handbook	Accreditation site visit team		everything that accreditation team given to use = boundary object?

Table 8-3 Research Record Excerpt phase two

CLIENT TRAJECTORY

Table 8-4 sets out the clinic pathways for a routine mammogram.

CLIENT CATEGORY	CLIENT PATHWAY (trajectory) DESCRIPTION: Routine Mammogram
Round One: First screen	<p>Receive information [BST community education, GP, other source] and decision to screen → telephone to book appointment [concurrently registered with the program, tailored information e.g. check if lift phobia, breast implants, disability, previous screened by another service, no appointment slot available] → letter confirming appointment details and consent form/information on screening → arrive at BST [via lift, met in foyer and taken up stairs] → Reception [welcome, consent form, signage, alerts for client action] → consent form filled and checked for completeness → sent to inner waiting room [magazines, brochures, alerts, feedback forms] → radiographer calls to screen → screened [woman-radiographer exchange of information – undress – woman-machine interaction – dress] → sent to inner waiting room [radiographer check film quality, NB. This and following step eliminated for digital mammography] → film quality announced [OK so can leave, not OK need rescreen] → allowed to leave → Client record QA → results letter = 'no evidence of cancer' OR → tagged for further assessment clinical pathway → <i>counsellor phone to arrange for further assessment</i></p>
Round 2+: Second plus screen (2 year cycle) Annual recall: High risk (family history) but no symptoms (1 year cycle)	<p>Reminder letter with suggested appointment date → telephone to [book, change booked] appointment [tailored information eg. lift phobia, breast implants, disability, no appointment slot available] → W1c] → letter confirming appointment details and consent form/information on screening → arrive at BST [via lift, met in foyer and taken up stairs] → Reception [welcome, consent form, signage, alerts for client action] → consent form filled and checked [completeness, NAS issue esp. Aboriginal identification] → sent to inner waiting room [magazines, brochures, alerts, feedback forms] → radiographer calls to screen → screened [woman-radiographer exchange of information – undress – woman-machine interaction – dress] → sent to inner waiting room [radiographer check film quality, NB. This and following step eliminated for digital mammography] → film quality announced [OK so can leave, not OK need rescreen] → allowed to leave → Client record QA → results letter = 'no evidence of cancer' OR → tagged for further assessment clinical pathway → <i>counsellor phone to arrange for further assessment</i></p>
Double appointment: Variations	<p><i>Breast implants/disability/CALD²²</i> → double appointment/special arrangements <i>No appointment slot available</i> → [advised to call again later, put on MS Access data base wait list] → data staff phone to advise appointment slot available → <i>Cancel and rebook</i> → letter confirming appointment details and consent form/information on screening → <i>FTA</i> → reception staff note 'fail to attend' and telephone to offer new appointment [data staff document outcome of three calls before give up] <i>Previous screened by another service</i> → triggers BST action to get copy of x-rays if possible from that Service to go in client record file. <i>Interval cancer</i> → Menzies Research Centre notifies BST → client is discharged from the Program [notification by letter; decision not to notify]</p>

Table 8-4 Trajectories of PPT-Interactions for a Routine Mammogram

²² CALD: culturally and linguistically diverse, needing translator

There is a standard sequence of events experienced by a client for a routine screening mammogram. Client categories are well-defined and are linked to variations in work and communication processes set out in the National Accreditation Standards (NAS). The description generated by the research approach is more detailed than the organisation flow chart of the client pathway. It includes additional activities not formally specified but observed by the researcher (and justified by staff members) as “we have to look after our ladies”. For example, data staff members taking a telephone booking check if clients have a lift phobia and arrange for a staff member meet the client in the foyer and escort the client up otherwise locked fire stairs.

RECURRING CONVERSATIONS

The range of data and interim analysis documents in the *Research Record* (Table 8-2 and Table 8-3) was analysed for contested or recurring conversation topics and different stakeholder descriptions of problem situations (Table 8-5).

PRESENTING PROBLEMS AT BST: ISSUES ON THE SURFACE

Recurring conversation topics among staff members

- “must **comply with the NAS**”
- Managing **professional sensitivities** of medicos (GPs and radiologists in particular);
- **Accreditation for quality** of service: standards, protocols, information access for staff and clients;
- “**We have to look after our ladies**” (clients);
- **Finding and persuading** the key community information providers (nurturing, growing relationships: e.g. hairdressers, editor of local council annual report - free advertisement);
- **Client ignorance** about breast screening program (cf ‘Agfest’ survey respondents’ ignorance on cost, age of eligibility to participate, location);
- Problems with unsuitable staff and **lack of qualified staff**;
- Managing the service under **constraints** (frozen funding and accreditation requirements to have certain screening rates);

From 05_05_08Mapping the space.doc

Recurring conversation topics during meetings

- Managing **recurring problems**: backlogs (client record onto the client information system), insufficient appointment slots, falling behind compliance with NAS standards, individual clients who ‘fall through the cracks’
- feeling pressure about **backlogs** processing the client record onto the client information system
- “Problem” staff members not committed to **data quality and completeness** (data entry staff; contract clinicians)
- How to manage professional clinicians not committed to the NAS (‘collegial’ approach by ‘designated’ clinicians to **influence professional clinical practice** to comply with NAS, cannot enforce)
- How to manage **insufficient clinical staff** for workload (or work systems need to be smarter)

From cross-field notes analysis of ‘info’ and PR&QMC meetings

Recurring conversation topics recorded in reflective memos

- The **NAS standards**: necessary, pervasive, frustrating, arduous, fossilised, needing to be “driven” into the work practice, worked around, “too much” and therefore “just enough”
- Frustration and difficulty **getting performance information** from the CIS (recruiting staff finding it hard to get information off the CIS to measure effectiveness of their education efforts; can’t measure data staff performance; only radiologists get feedback)
- Difficulties managing **client expectations** of appointment booking time frames and the “hidden” waitlist database
- The NAS is “a bit fossilised” (e.g. for digital mammography – development of standards slower than development of BS practice)

From cross- analysis of reflective memos

Table 8-5 Recurring conversations and presenting problems for BST

PROBLEM STORIES – ORGANISATION PERSPECTIVE

The researcher grouped the rich picture problems into stories focused on artefacts, work practice and accreditation (see Table 8-6).

PRESENTING PROBLEMS FOR BST	PROBLEM STORIES
Breakdowns in wider system of client record (CR) and client information system (CIS) interactions; Workarounds the CIS for managing client expectations of appointment booking time frames (NAS conflict); CIS not able to deliver information on performance to most staff members e.g. recruiting staff (NB radiologists get feedback from client record data and record on CR assessment of film quality for radiographer); Client record problems: backlogs processing client record, “system has a life of its own”, data quality and completeness, NAS compliance.	DATA ARTEFACT and DATA PRACTICE STORIES
Work to prevent individual clients ‘falling through the cracks’; Staffing problems: insufficient clinical staff for workload (or work systems need to be smarter); Control issues (‘collegial’ approach by ‘designated’ clinicians to influence professional clinical practice to comply with NAS - cannot enforce).	CLINICAL PRACTICE STORIES
Conflicting perspectives allocating blame for backlogs, insufficient appointment slots, falling behind compliance with NAS standards – radiographers and data staff Data and Clinic Practice Work to identify, address and prevent NAS compliance failure due to (i) data management breakdowns (individual and work practice system), (ii) clinical failures (individual and work practice system); Data Work to construct NAS compliance reports; Data Work to explain NAS compliance failures; No NAS standards for digital mammography – development of standards slower than development of breast screening practice	ACCREDITATION STORIES

Table 8-6 Classification of problem stories

PROBLEM STORIES – CLIENT PERSPECTIVES

Table 8-7 sets out two client expectations and practices that were problematic for BST, the organisation and staff members' responses and perspectives.

CLIENT EXPECTATIONS NOT MET and CHALLENGING PRACTICES		
	I can get an appointment	I can have my routine screen just before I go interstate on holidays
ORGANISATION RESPONSE	<ul style="list-style-type: none"> Management initiative: staff planning day ('work smarter not harder') and construction of 'team-based' meetings as forum for identifying work practice improvements Regular discussions on limiting screening offers to target clients (exclude 40-49 and 70+ years) 	Notices to clients in the screening clinic requesting clients to inform BST if going on holidays within next two weeks
ORGANISATION PERSPECTIVE	Radiographer capacity issues mean cannot meet demand for screening appointments – recruitment "too successful"	If recalled for assessment and client not available then the client cannot be assessed within the NAS timeframe and we fail the standard
STAFF PERSPECTIVES (conflicting, contested)	<ul style="list-style-type: none"> Data and management staff members frustrated and blaming the 'poor work ethic' and lack of physical fitness of radiographers Radiographers want protection from management expectations of increasing screening rate The aging population means participation rate dropping despite increasing numbers screened We should provide screening after hours for working women 	<ul style="list-style-type: none"> Clients like to get their mammograms done before going on holidays Clients don't understand that might be recalled for further assessment Clients don't understand that they can't be assessed by a Service in Perth if registered and had a routine screening mammogram in Hobart
ENTERPRISE PERSPECTIVE: National Accreditation Standard	<ul style="list-style-type: none"> Only well women aged 40 years and over are eligible to register for the Program of which 50-69 year olds are the target client 70% of target age population in the State to be screened every two years 	<ul style="list-style-type: none"> Strict timeframe for definitive diagnosis requires assessment clinic attendance within two weeks of routine screening Clients can only be registered with one Service at a time and the client record is kept by the Service

Table 8-7 Perspectives on Client expectations BST is unable to meet

Client expectations (the subject of client communications of disappointment or complaint) that the organisation could not meet included:

- I can get an appointment for the date on my invitation letter;
- I can to use my screening films for other purposes;
- I can make an appointment for five weeks time;
- I can have a mammogram if I have a symptom (e.g. lump);

- I can turn up at a clinic without an appointment and have a mammogram.

BST was faced by a wicked problem situation: ***How to identify and meet client expectations for the breast screening service when those expectations contradict or challenge the premises underlying an accreditation standard?***

PPT- FRAMEWORKS EXPLORATORY AND REFLECTION QUESTIONS

<p>Questions that focused on the client record as a <i>mediating artefact</i> (Hutchins, 1995a)</p> <ol style="list-style-type: none"> 1) What is the role of the client record viewed as a <i>mediating artefact</i> for different contexts of PPT-interactions? 2) In what way is the data on the client record artefact different to the data records on the client information system? 3) What are the differences in how <i>data analysis and management</i> staff uses the client records and how <i>clinical</i> staff members use them? 4) What factors influence these differences?
<p>Questions that addressed the issues of <i>membership</i> and <i>multi-membership</i> (Wenger, 1998) as properties of the research setting</p> <ol style="list-style-type: none"> 1) What are the differences between use of individual client records and the NAS data record (aggregated client record data) by staff members? 2) What is the role of the aggregated client record data in clinical practice? 3) Why do clinical professionals use personal interactions with recognised experts to find out 'current best practice' for breast screening organisations? 4) Why is there no benchmarking across all screening Service organisations? 5) Why can the client record be used as a coordinating mediating artefact across a group of professionals but the NAS data record cannot? 6) What is the role of the client record in the (clinical) multi-disciplinary meeting? 7) Why do they focus on individual client records and not the aggregated client data record? 8) Why is the NAS data record used to provide feedback for individual radiologists of key performance indicators but not used: <ol style="list-style-type: none"> a) in the professional accreditation schema for continuing accreditation of individual radiologists? b) for performance feedback or accreditation of other clinical professionals?
<p>Questions that focused on the client service and the data oriented staff members</p> <ol style="list-style-type: none"> 1) What work activities in each <i>community of practice</i> are required to comply with the NAS and which represent locally developed practices? 2) What artefacts used in each <i>community of practice</i> are <i>reified practice</i> and which are required to comply with the NAS? 3) What perspective does the NAS express on the roles, responsibilities and benefits of membership of BreastScreen Australia for a breast screening organisation? 4) In what ways is the NAS perspective reflected in the assumptions built into the design of the information systems and work practices within BST?
<p>Questions that teased out differences in perspectives between groups of work practices (human activity systems) in different areas in BST (Engeström, 1999)</p> <ol style="list-style-type: none"> 1) What is the significance of different rules [accreditation] for: <ol style="list-style-type: none"> a) the [breast screening] service (organisation-level)? b) [clinical] service provision to individual clients (individual-level)? c) a national Program of breast screening women (enterprise-level)? 2) What is the relationship between accreditation (rules) and community membership (values) in the work of [data, clinic, management, administration, recruitment] staff members?
<p>Questions to investigate different perspectives regarding the purpose of BST artefacts for the different activities identified (organisation-level accreditation, individual-level accreditation and for supporting screening and assessment clinical practice)</p> <ol style="list-style-type: none"> 1) What artefacts are used for organisation accreditation and how are they used? 2) What artefacts are used for individual-level accreditation and how are they used? 3) What artefacts are used in the practice of screening women for breast cancer (clinic and recruiting) and how are they used? 4) What level of integration is there between artefacts for organisation-level accreditation and individual-level (clinician) accreditation? 5) What level of integration is there between use of the client record artefact for accreditation and its use in the practice of screening women for breast cancer (clinic and recruiting)?

Questions that encouraged critical reflection on the effects of different boundaries
<ul style="list-style-type: none"> • What are the differences (social, cultural, structures and processes) that constitute social boundaries between the [data, ...] staff workers and [clinical] staff workers? • What theoretical lenses can account for the differences between the [data, ...] and [clinical] work perspectives on the client data record? • What is the role of external constraints (e.g. linking organisation funding to its accreditation status) in the development and use of artefacts (e.g. the client record and the National Accreditation Standards)?

Table 8-8 Data Interrogation Questions derived from PPT- frameworks

CONFLICTING PERSPECTIVES – RADIOGRAPHER WORK PRACTICES

Table 8-9 is an example of data of conflicting perspectives within BST regarding radiographer work practices and researcher notes identifying relationships between radiographer work practices and recruitment and data work practices. The ‘wicked problem’ for BST is the requirement to screen 70% of the population of target clients in a context where there are insufficient radiographers to meet the demands of the NAS and of the existing group of registered clients.

Conflicting Perspectives on radiographer work practices	Relationships between work practices (radiographer, recruiting and data)
<p>Radiographers In the morning tea room there was discussion by two radiographers about how “someone in the data staff has booked every single slot.” The radiographers complained there was no time for morning tea or any lee way for when they got behind, for example, if there are large ladies “12 filmers” or “ladies with walking sticks.” “We are on the front line here”. “We are not just technicians”.</p> <p>Project Officer [Name] was given the task of benchmarking the radiographers: “that makes me as popular as a maggot in a butcher’s shop”.</p> <p>Data support staff [Name] asked a data staff person how she was going. The [person] was upset because they had to do 160 re-bookings because of changes in the radiographers’ work shifts, which put them behind and was also very hard to do: “One lady’s appointment had to be changed twice!”</p> <p>Data Manager “No one else gets morning tea; everyone else grabs lunch when they can.”</p> <p>Program Manager comment “It’s about how they do their screening and why they do their screening, and the objective of the program is to screen as many women as we can. ... it is about an appropriate blend of providing an efficient service It’s not about looking after one woman’s individual needs; it’s about looking after all women’s mass needs.”</p> <p>Field notes and interview transcript quotes</p>	<p>Clinic work practices to process clients and record client data interact with data work practices to enter client data onto the client information system and process it the data into reports.</p> <p>Clinic work outputs and outcomes have a direct impact on data-oriented staff members: any changes to radiographer availability for clinic shifts creates work for data support staff members (rebooking appointments); incomplete client records are returned by the Assistant Data Manager to the Designated Radiologist for correction before data can be entered on the client information system database.</p> <p>Successful recruiting work (large number of clients booking screening appointments) adds to client processing problems due to insufficient radiographer capacity to meet demand to screen already registered clients. This is in a context where screening participation rates are linked to a NAS metric.</p> <p>Radiographers do not want to change how fast they work and resist suggestions to increase the number of appointments/hour by changing work practices (e.g. clinic support staff take over role of communicating with clients and preparing them for the breast x-ray).</p> <p>Researcher memos and analysis notes</p>

Table 8-9 Conflicting perspectives and radiographer work practices

PPT-FRAMEWORKS AND FIELD DATA

FOCUS/ UNIT OF ANALYSIS	CONSTRUCTS	FIELD DATA	TRAJECTORIES
<p>DISTRIBUTED COGNITION</p> <p>Unit of Analysis Functional cognitive system and linked sub-systems (composed of people, material environment (place) and things (mediating artefacts))</p> <p>Focus</p> <ul style="list-style-type: none"> • Cognition as a cultural and social process • Cognition as computation: proceeding by coordinated propagation of representational state • Cognitive properties individual and group level • Main interest in data and information flows: Addresses social 	<p>Cognitive work/activity as an historical cultural process</p> <p>A moment of practice: the intersection of three developmental sequence:</p> <ul style="list-style-type: none"> ○ conduct of the activity ○ development of practitioners ○ development of the practice <p>Artefact mediating cognition</p> <ul style="list-style-type: none"> ○ Team work as a computational system; artefacts as task-transforming representations ○ Social organisation as computational architecture ○ Activity conducted by operation of functional systems that co-ordinate representational media (inside/outside individuals) ○ Compensation for breakdowns: team members changing normative 	<ul style="list-style-type: none"> • Interviews with senior staff members all discuss development and impact of the National Accreditation Standards on organisation activities and culture <p>Conduct of the activity</p> <ul style="list-style-type: none"> • Observations: clinic staff screening and assessing clients; radiologists 'reading' mammograms; data staff at work <p>Development of practitioners</p> <p>Interview with Designated radiologist: discussion of relations between individual training, skill and experience; impact of NAS on the professions involved in breast screening; his role overseeing the clinical work</p> <p>Development of the practice</p> <ul style="list-style-type: none"> ○ Participant Observation: Organisation meetings and documents discussing and deciding changes to work practice systems and observation of changes ○ Observation of Business Process Analysis project and interview with analyst on tensions between 'as is' and 'to be' process maps for a new client information system (CIS), cultural, economic and political factors constraining the 'success' of the project ○ Interviews with staff members exploring attitudes and beliefs about existing and possible new work practice systems and relations between the existing CIS and 	<ul style="list-style-type: none"> • Client ↔ Client Record (physical folder) ↔ Client Information System • Career trajectory: data staff • PPT interactions between Clinic area and Data area • Errors and breakdowns and perceptions of competence

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<p>aspect of work via discussing their role in determining what information is shared and who generates, uses it</p> <p>Boundaries Possible cognitive systems: processes internal to an individual; individual in coordination with a set of tools, group of individuals in interaction with each other and a set of tools.</p>	<p>procedures to ensure necessary propagation of representational state.</p> <p>Work practices systems as distributed cognition (task plus coordination)</p> <ul style="list-style-type: none"> ○ Computations distributed across social organisation; ○ Cognitive consequences of division of labour ○ Learning as propagation of organisation through an adaptive system ○ Work Systems as a context for learning (career trajectories; horizon of observation; knowledge distribution/sharing, learning from error; scaffolding for learning provided for novice by other team members) ○ Cognitive work as a system of interactions among media both inside and outside the individual' (287) • Processes that drive cultural change (324) and principles for reorganisation of computation 	<p>work practices</p> <p>Artefact mediating cognition</p> <ul style="list-style-type: none"> ○ Structure of Client Record and CIS; propagation of representations of women's breast and cancer status; Interview Project Officer: exploring role of new policy and procedure manual; clinic manual in work practice system; Participant observation meetings: documents basis for discussion; role of NAS manual in constraining decision making processes ○ Observation field notes: use of client record (CR) in clinic work practices; use of CIS and CR in data work practices; Observation of preparations for accreditation visit and use of artefacts eg. "decision tool" ○ Observation of teams at work (clinic; data; recruitment; administration); observation team meetings ○ Observations: staff members taking on others' roles to clear back logs of CR needing processing; actions to compensate for insufficient radiographers; reorganisation to repair consequences of miscommunication ○ Staff member 'wish list' for new CIS from business process analysis project <p>Work practices systems as distributed cognition</p> <ul style="list-style-type: none"> ○ Observation of assessment clinic ○ Observation of clinics (routine mammogram; assessment); observation of data staff ○ Interviews: Data Manager and Assistant Data 	

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	<p>(data available; normative description; modularisation; computational and social organisation fit).</p> <ul style="list-style-type: none"> Cognitive properties from the processes transforming representational states within the system. 	<p>Manager and informal interview data staff members; Interviews: Program Manager; Designated Radiologist and informal interviews clinic reception and radiographer staff members; Interviews and participant observation recruitment staff; Observation: new staff induction (radiologist; radiographer locums, data staff locums)</p> <ul style="list-style-type: none"> Use of NAS in normative role to drive quality improvement agenda; use of CIS for operational and accreditation purposes; problems with staff members resisting changes; DHHS restructure; BST structure and restructure; 	
<p>COMMUNITY OF PRACTICE Unit of Analysis Local (socially engaged) community of practice Focus A social theory of learning (experience and practice) Boundaries Boundary based on limits of social production of meaning</p>	<ul style="list-style-type: none"> Community of Practice Negotiated meaning Emergent structures Experiential/social context Boundary interactions Engagement Imagination Alignment Identity transformation Trajectories of participation (community level and institutional level) infrastructures of learning 	<p>Community of Practice</p> <ol style="list-style-type: none"> Observation: staff members at level of individual, team and whole of staff negotiating systems for work practices (corridor discussions, team meetings, management meetings; staff planning day (participant observation)) Observation of team or group activity involving knowledgeable and skilful action (clinics, data staff) Observation: new staff members and experienced staff members interactions Interview: Designated Radiologist and Program Manager on staff development from professional clinician viewpoint and organisation viewpoint <p>Boundary Objects</p> <ol style="list-style-type: none"> Observation: staff members purpose in use of 	<ul style="list-style-type: none"> new and temporary staff members interactions in work environment staff members interactions with CR and CIS NAS-development over time; implementation over time into systems (WP

FOCUS/ UNIT OF ANALYSIS	CONSTRUCTS	FIELD DATA	TRAJECTORIES
	<ul style="list-style-type: none"> • Boundary objects • Brokers • Constellation of Practice <ul style="list-style-type: none"> ○ Multi-membership ○ Local/global interplay • organisational theory construct: 'network of practice' • McEchern (1934) and Halverson (2003): two different constructs called 'system of practice' 	<p>artefacts (CR, CIS, post-it notes, scrap paper, email</p> <ul style="list-style-type: none"> b) Document: NAS manual and artefacts for accreditation compliance c) Interview: Designated Radiologist and Program Manager, informal interviews various staff members on role of NAS in design of work practice and information systems <p>Brokers</p> <ul style="list-style-type: none"> a) Interview: Designated radiologist, Program Manager on role of Designated professional clinicians in the breast screening Program and role of Program Manager; informal interviews with various staff members on same issue b) Observation: multi-disciplinary meetings within organisation and as part of clinician professional development program <p>Constellation of Practice</p> <ul style="list-style-type: none"> a) Observation: Various communities of practice interactions within breast screening program (within local organisation and within national Program); Document records of interactions with other Service organisations. b) Interview: Program Manager, Data Manager and Assistant Data Manager, Recruitment officer; Counsellors; Policy officer on role and relations between various institutional structures and multiple roles filled by some individuals within and beyond organisation boundary c) Public and Environmental Health Service (PEHS) and 	<p>and IS);</p> <ul style="list-style-type: none"> • Interactions between different COPs within, and outside boundaries of the organisation

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		BreastScreen Tasmania (BST) planning days-interplay between institutional and local communities of practice.	
ACTIVITY THEORY Unit of Analysis Activity as a process with historical, cultural and temporal aspects of any workplace environment process developing over time Focus Activity mediated by rules, instruments, division of labour, community Boundaries Follow trajectories of interactions for an activity; crossing many social, physical and organisational boundaries	Knowledge as socially constructed <ul style="list-style-type: none"> • Activity/ action/ operation distinction and relations • Subject/object mediation by: rules, instruments, division of labour, community • Multiple perspectives (Subject/Object) • Alignment • Breakdowns • Scripts • Knots • Trajectories of activities (developmental process) • Core principle of AT is “the distinction between collective long-term activity, individual or group short-term action, and automatic, routinised operation – and movement between the three” 	1) Interviews: with Designated Radiologist, counsellors, Program Manager, Data Manager, 2) Observation of activities: multi-disciplinary meetings for clinicians; recruiting clients; registering clients; preparing for a clinic; running a clinic; preparing for accreditation; accreditation compliance; reporting for accreditation	<ul style="list-style-type: none"> • Clinicians, counsellors, reception staff members interacting with each other and clients during an assessment clinic • Client ↔ Client Record (physical folder) ↔ Client Information System • Career trajectory: data staff • PPT interactions between Clinic area and Data area

Table 8-10 PPT Frameworks and Field Data

ACCREDITATION AND PRACTICE ANALYSIS

Table 8-11 is the data analysis to identify the different relationships between: individual practice; community practice (COP); organisation practice; accreditation of individual; accreditation of profession; accreditation of organisation. It incorporates PPT-constructs.

This was a living analysis document and some PPT-constructs trialled were subsequently dropped. Table 4-7 was based on this table, but the schema adapted during further analysis.

RELATIONS BETWEEN: INDIVIDUAL PRACTICE; COMMUNITY PRACTICE (COP); ORGANISATION PRACTICE; ACCREDITATION OF INDIVIDUAL; ACCREDITATION OF PROFESSION; ACCREDITATION OF ORGANISATION	
INDIVIDUAL ACCREDITATION	ORGANISATION ACCREDITATION
Accredited to participate in the COP's domain of enterprises <ul style="list-style-type: none"> • within a given grouping of individuals labelled professionals • identified as sharing sufficient repertoire and competence • authority and status to enter into membership and practice 	Accredited to organise and coordinate engagement in a given enterprise <ul style="list-style-type: none"> • within a given enterprise domain • authority and status conferred = objectively measured as competent to best practice quality standard
Membership mediated by processes (developed within COP)	Membership mediated by processes (imposed by accrediting COP)
Authenticated by boundary objects <ul style="list-style-type: none"> • reifications of COP accreditation practice (certificate) • created to mediate introduction to and transfer of professional member between constellation of enterprises 	Authenticated by boundary objects (categories naturalised to authoritative status = regime of objects constituting a boundary infrastructure)
Boundary maintenance <ul style="list-style-type: none"> • definition of membership developed and asserted • mechanisms for individuals to be accredited for membership • individuals authorised as competent to use COP reifications and participate in COP enterprises 	Boundary maintenance <ul style="list-style-type: none"> • revision of accreditation for membership requirements (standards) • monitoring implementation of accredited COP practice and boundary objects into service COP practice • production of boundary objects for use by Service or use by accrediting COP
Brokers	Brokers

RELATIONS BETWEEN: INDIVIDUAL PRACTICE; COMMUNITY PRACTICE (COP); ORGANISATION PRACTICE; ACCREDITATION OF INDIVIDUAL; ACCREDITATION OF PROFESSION; ACCREDITATION OF ORGANISATION	
<ul style="list-style-type: none"> referees who introduce an individual to an institution <ul style="list-style-type: none"> as accredited (appropriate competence and repertoire) for work on an enterprise institution members (HR, interviewers) who approve individual for the position <ul style="list-style-type: none"> as accredited to work within the institution baseline accreditation then foundation for demonstrating competence over time, trajectory of membership into COP within institution 	<p>Different broker types depending on focus</p> <ul style="list-style-type: none"> Accrediting COP member developing standards and boundary objects for Service COP use Designated professional (e.g. radiologist) overseeing elements of clinic COP practice against accrediting COP requirements <p>Designated broker → institutional broker</p> <ul style="list-style-type: none"> agents devoted to boundary maintenance appointed to task by organisation (institutional decision, not informal) with specific responsibility and authority
<p>Accrediting COP (representative members from within the COP)</p> <ul style="list-style-type: none"> Role of certificate (boundary object to verify person's quantifiable status as suitable for membership) Role of referee (broker to introduce person for transfer from one COP to another comparable COP—quantifiable (confirmation of experience in elements of practice) and qualitative assessment (assessment of individual competence for a different context of the same practice elements)) 	<p>Accrediting COP (representative members from the constellation of COPs engaged in various relevant enterprises and representatives from service organisation)</p> <ul style="list-style-type: none"> Cf constellation of practice,
<p>Accrediting COP for professional group (clinicians)</p> <ul style="list-style-type: none"> Passport to membership of COP in organisation (boundary object = certificate) and authorisation to participate in practice Sets and monitors continuing education requirements Conduit for COP specific education, information Advice, support 	<p>Accrediting COP for an organisation providing a service to standard quality</p> <ul style="list-style-type: none"> Letter of accreditation (boundary object = letter advising accreditation status) to membership of constellation of COPs delivering same service Authorisation for service delivery Basis for continuing funding for practice
INDIVIDUAL PRACTICE	ORGANISATION PRACTICE
<p>Organisation determines framework (context, boundaries) for individual to practice profession (= interpretation of how organisation accreditation framework is to influence COP practice)</p>	<p>Accrediting COP determines accreditation framework for organisation to operate within</p> <ul style="list-style-type: none"> Some negotiation of details: consultation with NQMC (explanation/

RELATIONS BETWEEN: INDIVIDUAL PRACTICE; COMMUNITY PRACTICE (COP); ORGANISATION PRACTICE; ACCREDITATION OF INDIVIDUAL; ACCREDITATION OF PROFESSION; ACCREDITATION OF ORGANISATION	
<ul style="list-style-type: none"> Some negotiation of details: organisation consultation with COP members (participation/reification learning context); flexibility with regard to 'how' achieve NAS outcomes Some non-negotiable areas (NAS powerful boundary infrastructure) 	<p>justification); membership on committees developing and reviewing NAS framework</p> <ul style="list-style-type: none"> Some non-negotiable areas (NAS as boundary infrastructure: acceptance of core categories and standards as correct, only minor changes; philosophy of quality improvement framework and screening ethos unchallenged)
<p>COPs within the organisation influence how individuals within the service COP practice as an accredited professional and coordinate with others</p> <ul style="list-style-type: none"> Trajectory of membership <ul style="list-style-type: none"> Entry via certificate (accreditation) Peripheral to full membership via acquiring repertoire of skills and knowledge, and competence in use of reifications of practice Personal qualities and competencies <ul style="list-style-type: none"> Trust (demonstrated in practice that competent) Responsibility (trusted to act) Authority (natural authority, power to negotiate) 	<p>Accreditation framework defines the domain of operation for a COP / constellation of COPs engaged in a shared enterprise</p> <ul style="list-style-type: none"> provides boundary definition defines boundary maintenance activities required <p>Accreditation framework defines the eligible COPs from which to draw eligible individuals for membership in the organisation (and thus the COPs within it).</p>
<p>Brokers</p> <ul style="list-style-type: none"> introduction and translation of elements of source COP practice (eg. radiology) into service COP practice occurs where overlapping or interconnecting enterprises authority 	<p>Agent-Brokers</p> <ul style="list-style-type: none"> Inculcate accreditation categories as boundary infrastructure and implement and/or prioritise organisation objects which align to accreditation priorities Implement and monitor accreditation compliance using organisation objects as boundary objects <ul style="list-style-type: none"> Reports to accrediting COP Feedback to service organisation members
<p>Individual members of the constellation of breast screening service organisations take on brokering roles as representatives of the constellations of COPs (professional groups; program managers)</p>	<p>The organisation is permitted to continue operating as a coordinated collection of COPs delivering a screening service by demonstration that achieving ongoing improvement and/or maintenance of defined standards</p>

RELATIONS BETWEEN: INDIVIDUAL PRACTICE; COMMUNITY PRACTICE (COP); ORGANISATION PRACTICE; ACCREDITATION OF INDIVIDUAL; ACCREDITATION OF PROFESSION; ACCREDITATION OF ORGANISATION	
Program managers have a role in identifying issues the national accrediting COP needs to address; and may participate in constructing the policies and procedures (rules) that the organisation COPs must then comply with	The COP responsible for funding decisions (political and economic considerations) uses the accreditation framework as a boundary object for communication between the organisation (BST) and how it establishes its eligibility for funding
Program managers make decisions which sometimes conflict with the accrediting COP rules: for example the decision to go ahead with 'digital' mammography without waiting for the NAS ruling (too slow)	The COP responsible for funding decisions (political COP) adds in its own boundary object: reporting mechanisms which draw on the accrediting reporting mechanisms (define and extract key indicators) for quality and performance evaluation
Service organisation COPs manage slowness of NAS standards change by creative decisions or compliance when not good, but have to do (eg. 28 day appointment frame).	<p>The organisation cannot influence the NAS framework as organisation. The Program Manager (designated as responsible for maintaining service quality as measured by NAS) has influence as individual on committees representing the organisation.</p> <ul style="list-style-type: none"> • Is Program Manager acting as agent of accreditation COP (negotiating and participating) or representative of BST? • Large COP (BS NSW) can make pragmatic decision and all other services must adjust (even though affects their capacity to keep accreditation status).
INDIVIDUAL/COP- PRACTICE BASED ARTEFACTS	ORGANISATION- ACCREDITATION BASED ARTEFACTS
<p>The client record (CR) is used to coordinate the screening practice of BST and as the primary data source for the database (DB)</p> <p>Three types of status: inactive (physically in storage); in use; 'suspended animation' awaiting information required to be entered on data base before can go to storage (or be archived)</p> <p>Clinic staff use of CR is different to data staff use</p>	
	<p>Data staff prepare artefacts associated with clinic practice (lists of clinic clients) from the DB and do a matching activity (list to physical CR)</p> <p>Data staff use to CR maintain data base for accreditation activities</p>
Clinic staff use CR to co-ordinate various activities of clinic COP	Data staff prepare CR for use by clinic staff for screening practice

RELATIONS BETWEEN: INDIVIDUAL PRACTICE; COMMUNITY PRACTICE (COP); ORGANISATION PRACTICE; ACCREDITATION OF INDIVIDUAL; ACCREDITATION OF PROFESSION; ACCREDITATION OF ORGANISATION	
<p>ROUTINE SCREEN CLINIC The support staff match DB generated appointment lists with CR</p> <p>Radiographers use the CR</p> <ul style="list-style-type: none"> • Take from top of pile for who is next (read name on list) • during screening to alert to variant information “relevant” to screening process (eg. breast implant-pink dot, disability) • Take printed client information labels to attach to films • Put films in CR • Add notes to form in CR <p>Clinic Support staff use CR and printed lists to ‘hang’ films for radiologist to ‘read’</p> <ul style="list-style-type: none"> • Boundary object reconfiguration: information presentation for radiologist information processing • Continuous error checking (radiologist error eg. Reading same film twice) • Objects: lists, CR and films, whiteboard, reading sheets for radiologists <p>ASSESSMENT CLINIC Clinic staff actively co-construct and maintain the CR (as a boundary object) throughout its use in the screening practice</p> <ul style="list-style-type: none"> • Professional clinical and counselling staff create objects to be incorporated into the CR (breast images, information onto forms, dictation of results to be typed and included) • Client also contributes via verbal information (filtered and recorded as counsellor’s notes) and physical marks (signature on consent form) • Support staff type outcome of definitive results dictated by surgeon/radiologist onto template letter for clinicians outside BST (GPs) <ul style="list-style-type: none"> ○ clinic support staff use CR when available to check 	<p>Data staff four categories:</p> <ul style="list-style-type: none"> • Data section screening support officer (client calls, CR construction and preparation for clinic use; QA for data entry from CR) • assistant data manager (QA of CR, ensure all information required been obtained from clinical staff and meets NAS standard for data quality) • data manager (overall running of Data service especially management for information security and quality, reports) <p>ROUTINE SCREEN CLINIC</p> <ul style="list-style-type: none"> • pick CRs from storage • match CR picking list to current appointment list • prepare labels

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<ul style="list-style-type: none"> ○ draft version checked by counsellor who ex-radiographer or clinical coordinator for accuracy and consistency <p>RESULTS CLINIC</p> <ul style="list-style-type: none"> • For women whose cancer status required outsourced pathology test • CR not used in presence of woman • Verbal delivery of diagnosis (recorded on forms held in CR) 	<p>Data section do not see the CR again until after the clinicians and counselling staff have finished with it (= once woman travelled the clinical pathway and has definitive cancer status diagnosis and either 'routine recall' or 'post surgery')</p>
<ul style="list-style-type: none"> • Clinic staff are required to enter the aggregated information in the CR compliant with the NAS and DB requirements • Clinic staff members have to keep track of the CR during assessment clinic and coordinate CR with other objects which have to be incorporated into the CR when construction complete or no longer required (films, forms). 	<p>Designated clinic staff are responsible for ensuring the clinic information is compliant with NAS requirements (checked after the clinic by the Assistant Data Manager – designated data staff, regulated by NAS timeframes)</p>
<p>Service staff members comprise nested COPs</p> <ul style="list-style-type: none"> • Support: processing boundary objects and awareness maintenance of client experience • Routine clinic service: radiographers plus clinic support staff <ul style="list-style-type: none"> ○ creating boundary objects (mammogram images) ○ processing boundary objects (client record) ○ awareness maintenance of client experience (verbal). ➤ Output of routine clinic is boundary object for radiologists to 'read films' and record judgment. • Assessment and results clinic service <ul style="list-style-type: none"> ○ radiographers: creating boundary objects (mammogram images) and awareness maintenance of client experience (notes on CR) ○ clinic support staff: processing boundary objects (CR record elements) and awareness maintenance of client experience (verbal) 	<ul style="list-style-type: none"> ➤ Output of radiologist activity is boundary object (CR): for data staff ('routine recall' enter CR information onto database) or for counsellors (data staff enter that 'recall to assessment' on DB from CR put CR on counsellor desk)

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<ul style="list-style-type: none"> ○ medical clinicians: creating boundary objects (images, letters, forms in CR) ○ counsellors: processing boundary objects (consent form CR record element) and awareness maintenance of client experience (verbal, case notes on CR) ○ client: verbal and written feedback on service experience 	
<p>White Boards are used in the assessment clinic</p> <ul style="list-style-type: none"> • permanent marks in form of columns with headings for required information • temporal marks (white board marker) = information placed in columns records the location on the clinical trajectory of each woman (information outcomes for each stage = decision for exit from pathway or next step (and which one) 	
<p>Post-it notes, sticky dot, disposable cards</p> <ul style="list-style-type: none"> • temporal information as memory aid, or communication to other staff members, or highlight information contained in CR (breast implants) • attached to CR 	<p>Post-it notes, scrap paper, disposable cards</p> <ul style="list-style-type: none"> • temporal information as memory aid (to do or to check later), guard against forgetting if interrupted, or communication to other staff members
<p>The database (DB) is the locus of boundary object maintenance for accreditation practice. It does have a role in screening practice: client's booking appointments and updated details are recorded on the database. This information is used to generate client lists (against which CRs are physically matched) and which are used as part of co-ordination of clinic COP members. It also generates client specific labels which are used throughout the screening process connecting and matching CR to films and reports. The main function is to be the locus of information which is incorporated into an electronic record of client specific information accumulated during the screening process and aggregated into the CR. This data can then be aggregated across clients and used to create various boundary objects to report against accreditation requirements to the accreditation COP.</p>	

Table 8-11 Data relations between accreditation and practice